United States Department of Agriculture

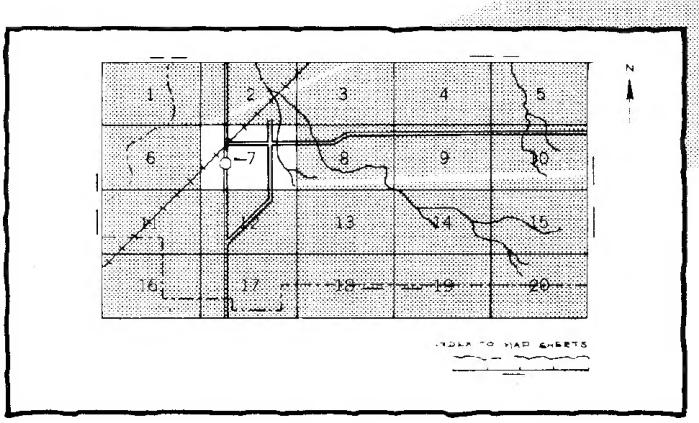
Soil Conservation Service

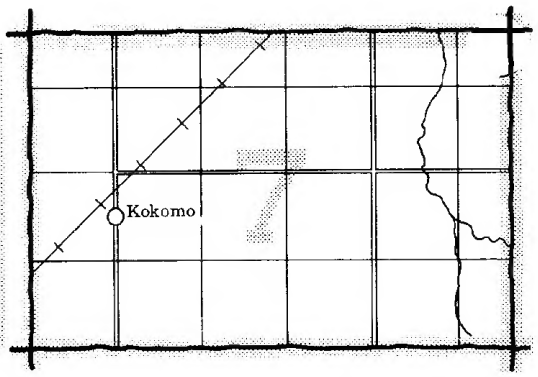
In cooperation with United States Department of the Interior, National Park Service, and University of California Agricultural Experiment Station

Soil Survey of Marin County California

HOW TO USE

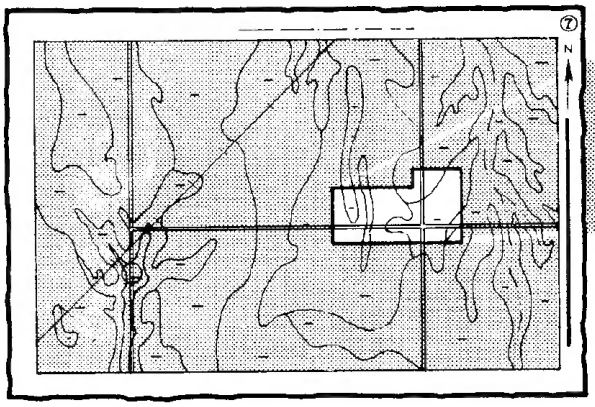
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

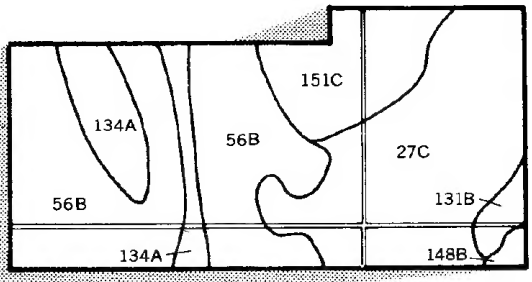




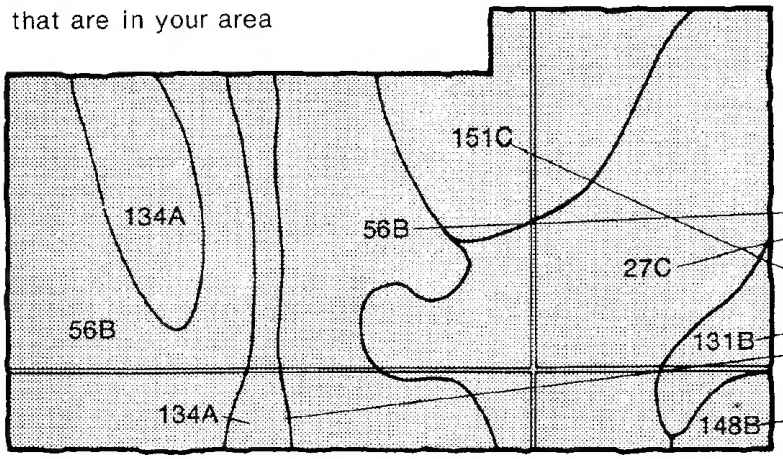
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area

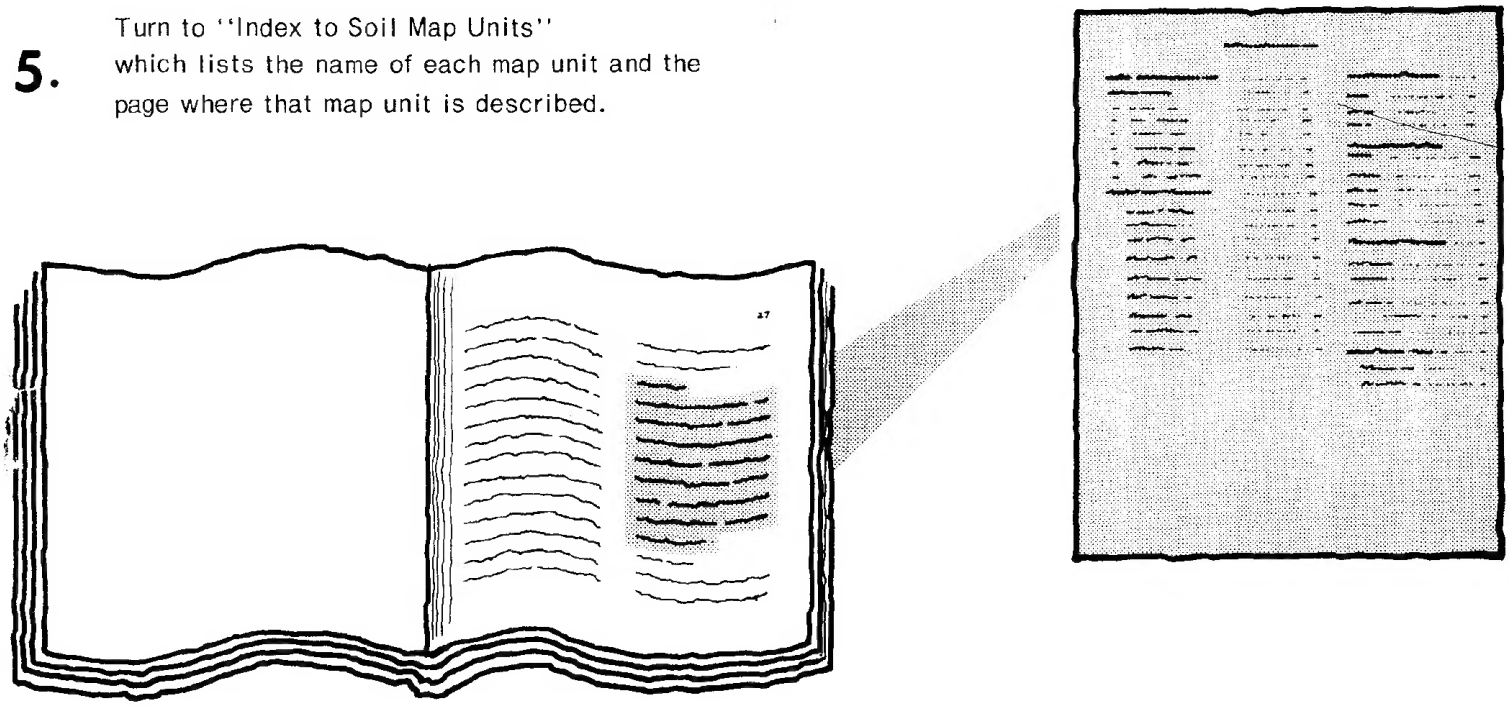


Symbols

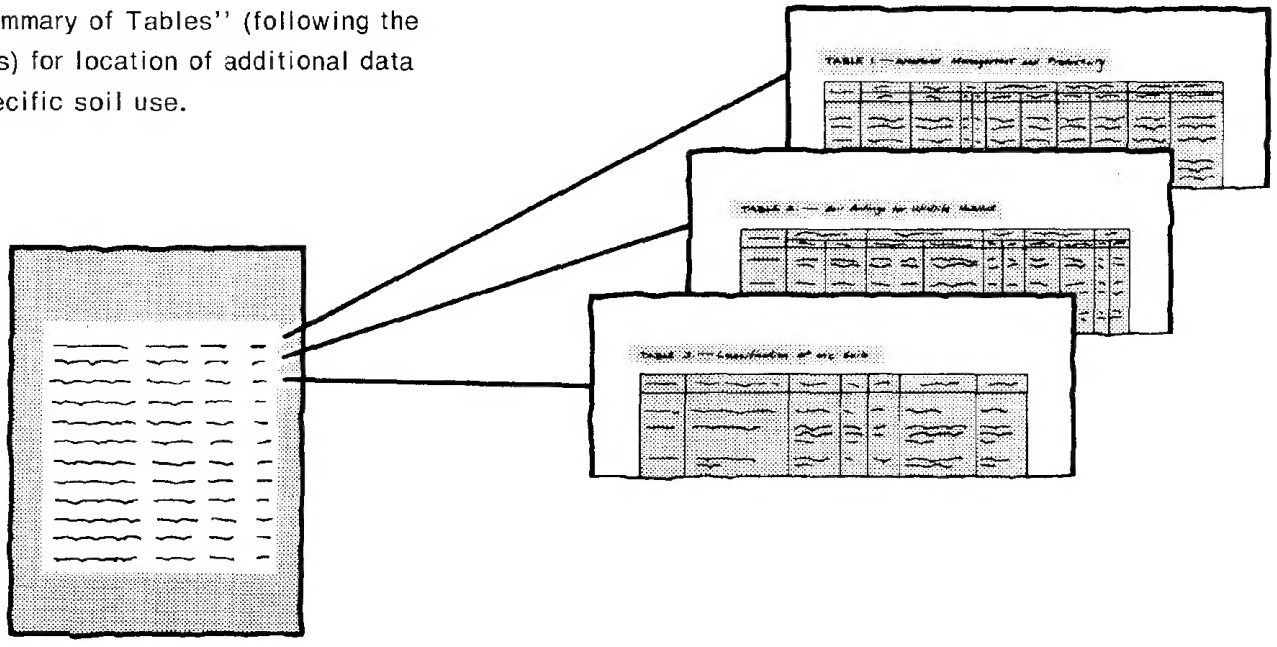
- 27C
- 56B
- 131B
- 134A
- 148B
- 151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1973-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. This survey was made cooperatively by the Soil Conservation Service, the National Park Service, and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Marin County Resource Conservation District.

Cover: Marin Headlands, north of Golden Gate Bridge. The soils are Tamalpais-Barnabe Variant very gravelly loams.

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Soil Series

Issued March 1985

Index to Map Units

Summary of Tables

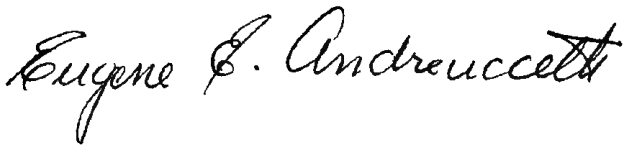
Foreword

This soil survey contains information that can be used in land-planning programs in Marin County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Additional information and help in using this publication are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Eugene E. Andreuccetti
State Conservationist
Soil Conservation Service

Location of Marin County in California.

Soil Survey of Marin County, California

By James H. Kashiwagi, Soil Conservation Service

Fieldwork by Robert W. Hansen, Christine A. Bartlett, Thomas A. Caudill, Leonard W. Jolley, Karen L. Wilson, Thor D. Thorsen, and Gordon E. Shipman, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
United States Department of the Interior, National Park Service, and
University of California Agricultural Experiment Station

MARIN COUNTY is in the northern part of California, in the California Coast Range. It is bordered by the Pacific Ocean on the west and by the San Francisco and San Pablo Bays on the east. Sonoma County is to the north. The total area of the county is approximately 332,800 acres, or 520 square miles. Elevation ranges from 2 feet below sea level to 2,500 feet.

San Rafael, the largest city in the county, is the county seat. Mill Valley and Novato are other important communities along U.S. Highway 101, which extends from north to south, the length of the county.

The San Andreas fault dissects the county in a northwesterly direction from the Bolinas Lagoon to Tomales Bay. The soils west of the fault and along the Pacific Ocean are in areas managed by the National Park Service. They are used for recreation and wildlife habitat and as watershed. In the central part of the county the soils are on moderately sloping to very steep uplands. They are used as rangeland and watershed and for wildlife habitat and recreation. In the eastern edge of the county the soils are used for urban development.

Part of Marin County was included in a soil survey published in 1917 (*7*). This survey has additional information about the county and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of the soils within the survey area.

General Nature of the Survey Area

This section provides general information about the settlement and development; physiography, relief, and drainage; water supply; transportation; and climate of the survey area.

Settlement and Development

The Miwok Indians were the first inhabitants of the survey area. They were present in the area in 1579 when Sir Francis Drake anchored off Point Reyes in what is now Drake's Bay and claimed the coastland for Queen Elizabeth I. He called it Nova Albion.

The Spanish established the first permanent European settlement in the area. In 1817 Franciscan friars founded Mission San Rafael Archangel. The land was tilled, and fruit trees, grapes, and grain were planted. The Spanish taught the Indians many crafts, such as boatbuilding, leather tanning, and metalworking.

In 1822 Spanish rule in California gave way to Mexican rule. In 1834 land was converted from church ownership to private ownership. This resulted in the breakup of the mission and the dispersion of the Indians who had lived there. The mission lands became part of the large land grants deeded to those who had rendered services to the Mexican Government. Arable land was tilled, and livestock was raised.

In 1848 Captain John C. Fremont secured the area known as Marin County for the United States. California became a state in 1850, and Marin County was one of

the original counties. It was the first county in California to develop a major dairy industry. In 1866 Marin County accounted for about 75 percent of California's dairy production. Since World War II, urbanization, water development, and park acquisition have reduced the farmed areas.

The population of the area increased from about 5,000 in 1880 to 206,758 in 1970. The opening of the Golden Gate Bridge in 1937 accelerated growth. Projected population figures indicate that 285,800 people will be living in Marin County by the year 2000.

Dairy farming is still the primary industry in the area. Other small industries such as boatbuilding; printing; manufacture of plastic products, cosmetics, and candles; oyster farming; and cheese production are also important to the economy of the county.

Physiography, Relief, and Drainage

Marin County is part of the hilly to steep mountains of the California Coast Range. The county is characterized by a number of northwest-facing mountain ridges and intervening valleys of varying widths.

The county consists of three general physiographic regions: (1) the rugged California Coast Range that ranges in elevation from near sea level along the Pacific Ocean and San Francisco Bay to 2,500 feet at Mount Tamalpais; (2) nearly level alluvial fans, alluvial plains, and flood plains in intermountain valleys that range in elevation from sea level to 500 feet at Nicasio; and (3) the low-lying tidal marshes along San Francisco and San Pablo Bays that range in elevation from 2 feet below sea level to 10 feet above. Most of the tidal marshes have been reclaimed by protective dikes and drainageways.

Numerous intermittent streams that flow for short periods in winter drain most of the county. Estero Americano; Estero De San Antonio and Walker, Olema, and Lagunitas Creeks and their tributaries flow into Tomales Bay and drain the western part of the county. San Antonio, Novato, Miller, and San Anselmo Creeks flow into San Pablo and San Francisco Bays and drain the eastern part of the county.

Water Supply

The main source of water for the county is surface water impoundments. Most of the water is supplied by the Marin Municipal Water District. It annually provides 6 to 9 billion gallons of water for domestic use. A small percentage of this water is used for firefighting. The water comes from six reservoirs. The largest of these are Nicasio Reservoir, which has a capacity of 7.4 billion gallons, and Kent Lake, which has a capacity of 5.4 billion gallons. The other reservoirs are Alpine, Bon Tempe, Lagunitas, and Stafford Lakes.

The rest of the water needs for the county are supplied by a number of publicly and privately owned water districts and companies. Unincorporated communities and areas that do not have access to municipal water supplies depend on wells and springs for water.

Transportation

The Golden Gate Bridge and the San Rafael-Richmond Bridge provide passage for automobiles, buses, and trucks, which are the major means of transportation in the area. Marin County has 124 miles of state highways and 420 miles of county roads. State Highway 101 traverses the eastern part of the county, and State Highway 1 traverses the western part.

The North Western Pacific Railroad provides freight services along the eastern edge of the county from Sonoma County to San Rafael. Gnoss Field, a county airport in Novato, provides commuter services to other metropolitan airports. A privately owned airport is in San Rafael, and a military airport is in Novato. Ferries operate from Larkspur, Tiburon, and Sausalito to San Francisco.

Climate

J. L. Hatfield, biometeorologist, University of California, Davis, assisted in writing this section.

Because Marin County is along the Pacific Ocean, the climate is characterized by moderate temperatures and moderate precipitation. The climate changes sharply in areas inland, where relief varies.

The temperature along the coast remains cool throughout the year and seldom drops below freezing. Temperature increases as distance from the coast increases; however, it rarely exceeds 100 degrees F or drops below 32 degrees in most of the county.

Most of the precipitation in the area falls during 6 months of the year. Only small amounts are reported during the rest of the year. The amount of precipitation is least in the northwestern part of the county, and it increases in areas southward toward the San Francisco Bay and inland. In areas inland, less fog and drizzle occur and the period of dry weather in summer is more pronounced.

The temperatures in the county are greatly influenced by the ocean; therefore, they are moderate throughout the year. The temperature and precipitation data recorded at Kentfield and San Rafael are shown in table 1. The mean annual temperature at Kentfield is 57.6 degrees and it is 59.6 degrees at San Rafael. The average maximum temperature is 55.2 to 83.5 degrees at Kentfield, and the average minimum temperature is 38.4 to 50.6 degrees. In winter the diurnal range is about 15 degrees, and in summer it is about 30 degrees. This results in a very long growing season throughout the county. It ranges from about 365 days near the coast to about 200 days in the northeastern part of the county.

The high temperatures in the county rarely exceed 95 degrees for a very long time. The warmer periods usually are followed by strong onshore breezes that cool the area. At the higher elevations in the northeastern corner of the area, a high temperature of more than 100 degrees has been recorded, but also only rarely.

Precipitation in the county is quite variable, ranging from 30 to 50 inches. Point Reyes Station along the coast and Novato on the inland side of the San Francisco Bay receive about 30 inches of precipitation annually. They receive more than 5 inches during each of the months of December, January, and February. San Rafael and Kentfield receive the highest amounts of precipitation in the county (table 2). Kentfield receives 48.6 inches annually, and San Rafael receives 36.6 inches. Precipitation falls throughout the year in all parts of the county; however, less than 0.5 inch falls during June, July, and August. Along the coast, fog and drizzle during the summer contribute to the moisture supply. In the inland areas, the summers are dry and fog only occurs early in the morning.

Winds generally are mild throughout the county. Local topography influences both the direction and velocity of the wind. In the unprotected areas, the wind generally tends to blow inland from the ocean during the afternoon in summer. This results in a moderate temperature throughout most of the year and particularly in summer.

The average relative humidity near the coast is about 80 percent throughout the year. In the inland areas, it ranges from 75 percent in winter to less than 60 percent in summer.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have

a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 17 map units in this survey have been grouped into three general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Soils on alluvial fans and plains, in basins, and on tidal flats

Four map units are in this group. They make up about 15 percent of the survey area.

The soils in this group are dominantly on the lower positions of the landscape in the eastern part of the survey area. The soils are nearly level to sloping. Elevation ranges from 2 feet below sea level at San Pablo Bay to 500 feet above sea level near Nicasio. The vegetation is dominantly annual grasses and forbs with scattered oaks.

These soils are deep and very deep and are somewhat poorly drained and very poorly drained. The surface layer is silt loam to clay.

This group is used mainly as hayland, pastureland, rangeland, and wildlife habitat. Some areas are used for urban development.

1. Blucher-Cole

Very deep, gently sloping, somewhat poorly drained soils; in basins and on alluvial fans

This map unit is in narrow drainageways and canyons throughout the county. The soils in this unit formed in alluvial deposits. Slope ranges from 2 to 5 percent. Elevation ranges from 0 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 61 degrees F, and the frost-free season is about 210 to 290 days.

This unit makes up about 3 percent of the survey area. It is about 35 percent Blucher soils, 30 percent Cole soils, and 35 percent soils of minor extent.

Blucher soils have a grayish brown silt loam surface layer underlain by gray silty clay loam and clay loam.

Cole soils have a gray clay loam surface layer underlain by dark gray and grayish brown silty clay.

Of minor extent in this unit are well drained Ballard soils, somewhat excessively drained Cortina soils, poorly drained Clear Lake soils, and some narrow stream channels.

Most areas of this unit are used as rangeland and pastureland. Some areas are used for urban development.

Available water capacity is high. Permeability is slow. The soils are wet and are subject to flooding during the rainy season.

This unit is limited for use as homesites mainly by the hazard of flooding, the potential for shrinking and swelling of the Cole soils, and wetness. It is limited for septic tank absorption fields by the hazard of flooding, wetness, and slow permeability. Special design of foundations and septic tank absorption fields is needed.

This unit is in areas dominated by annual grasses. The unit provides habitat for deer, California valley quail, dove, rabbits, rodents, songbirds, and birds of prey. Intermittent streams associated with willows and berry vines are common in the unit. Farm ponds and shallow water areas can be constructed for fish and wildlife, including waterfowl. Management practices that enhance wildlife habitat include proper grazing use, providing drinking water, preserving or planting streamside vegetation, constructing brush piles, and planting windbreaks.

2. Reyes-Novato

Very deep, nearly level, somewhat poorly drained and very poorly drained soils; on tidal flats

This map unit is on the eastern edge of the survey area, along the San Pablo and San Francisco Bays. The soils in this unit formed in alluvium derived from various

kinds of rock, sediment from San Pablo Bay, and hydrophytic plant material. Slope ranges from 0 to 2 percent. Elevation ranges from 2 feet below sea level to 10 feet above. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 58 to 62 degrees F, and the frost-free season is 270 to 320 days.

This unit makes up about 4 percent of the survey area. It is about 45 percent Reyes soils, 40 percent Novato soils, and 15 percent soils of minor extent.

Reyes soils are on reclaimed tidal flats and are somewhat poorly drained. These soils have a light brownish gray clay surface layer underlain by gray silty clay.

Novato soils are on tidal flats and are very poorly drained. These soils have a light brownish gray clay surface layer underlain by gray clay.

Of minor extent in this unit are well drained Ballard soils and somewhat poorly drained Blucher and Cole soils.

Areas of this unit that are reclaimed are used as hayland, as pastureland, and for some urban development. Areas under natural conditions are used for wildlife habitat.

Permeability of the major soils in this unit is slow. Water is at or near the surface during the rainy season. The soils are subject to subsidence and flooding.

The Reyes soils have been diked to protect them from tidal action, and they have been drained to increase crop production. These soils are adjacent to the San Francisco Bay and are in the higher lying areas adjacent to the Novato soils. The soils provide forage for deer and habitat for waterfowl. The vegetation on the levees and in odd areas provides habitat for California valley quail, dove, pheasant, rabbits, songbirds, and birds of prey. Management practices that enhance the wildlife habitat include constructing shallow water areas, planting or preserving shrubs and trees, leaving the plant cover on levees and in odd areas, and leaving standing grain as food for wildlife during winter.

The Novato soils have not been diked and are subject to tidal action. They are in the higher lying areas adjacent to the tidal mud flats of the San Francisco and Tomales Bays and along the creeks and sloughs that enter the bays. These soils are moderately alkaline or strongly alkaline. The vegetation consists mainly of pickleweed and other salt-tolerant plants, such as saltgrass, California cordgrass, saltmarsh bulrush, and wiregrass. The Novato soils provide valuable habitat for shore birds and waterfowl and for white-tailed kite, which are protected by the State of California Fish and Game Commission. The saltmarsh harvest mouse and the California clapper rail make use of the areas of pickleweed. The management practice most needed on these soils is retaining tidal action to maintain growth of pickleweed.

3. Urban land-Xerorthents

Urban land, and deep, nearly level to moderately sloping soils; on alluvial fans, alluvial plains, and tidal flats

This map unit is in narrow valleys that extend into the San Pablo and Richardson Bays, in the southeastern part of the survey area. Slope ranges from 0 to 9 percent. Elevation ranges from 0 to 500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 55 to 62 degrees F, and the average frost-free season is 270 to 350 days.

This unit makes up about 2 percent of the survey area. It is about 60 percent Urban land, 30 percent Xerorthents, and 10 percent soils of minor extent.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soils under these structures have been extensively graded and mixed or have been covered with fill material.

Xerorthents are areas that have been cut or filled and graded with heavy equipment. The fill areas are composed of varying amounts of soil material, gravel, and other solid material.

Of minor extent in this unit are Hydraquents, saline, and Novato and Reyes soils.

This unit is used mainly as homesites and for urban development and recreation.

Some areas bordering San Pablo and Richardson Bays are subject to flooding during the rainy season and during periods of high tide.

The natural vegetation on this unit is dominantly annual grasses, oak, and California laurel. Urban residences, commercial buildings, and roads, however, have replaced much of this vegetation. Occasional streams and waterways and associated streamside vegetation still traverse the unit. Irrigated lawns and landscaping plants provide habitat for urban wildlife, such as songbirds, dove, and pigeons. Management practices that enhance urban wildlife habitat include planting and preserving diverse flowering and fruit-producing shrubs and trees used in landscaping and providing drinking water, birdbaths, bird feeders, and birdhouses.

4. Xerorthents-Urban land

Deep, nearly level to sloping soils, and Urban land; on alluvial fans, alluvial plains, and tidal flats

This map unit is in narrow valleys that extend to the San Pablo and Richardson Bays, in the southeastern part of the survey area. Elevation ranges from 0 to 500 feet. Slope ranges from 0 to 9 percent. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 55 to 62 degrees F, and the average frost-free season is 270 to 350 days.

This unit makes up about 6 percent of the survey area. It is about 40 percent Xerorthents, 35 percent Urban land, and 25 percent soils of minor extent.

Xerorthents are areas that have been cut or filled and graded with heavy equipment. The fill areas are composed of varying amounts of soil material, gravel, and other solid material.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. Soils under these structures have been extensively graded and mixed or have been covered with fill material.

Of minor extent in this unit are Hydraquents, saline, and Ballard, Bonnydoon, Los Osos, Saurin, and Reyes soils.

This unit is used mainly as homesites and for urban development and recreation.

Some areas bordering the San Pablo and Richardson Bays are subject to flooding during the rainy season and during periods of high tide.

The natural vegetation on this unit is dominantly annual grasses and oak and California laurel in the sloping areas. Suburban residences, commercial buildings, and roads, however, now dominate much of the unit. The natural vegetation and irrigated landscaping plants in the unit provide habitat for deer, band-tailed pigeon, California valley quail, dove, rabbits, rodents, raccoon, skunk, birds of prey, and songbirds. Occasional streams and waterways and associated streamside vegetation still traverse this unit. Management practices that enhance the wildlife habitat include preserving open areas of natural vegetation; landscaping with diverse plants, including flowering and fruit-producing plants; providing drinking water for wildlife; providing brush piles near water and in open areas of grass; providing food plots; and preserving streamside vegetation.

Coastal soils on dunes, terraces, hills, mountains, and uplands

Eight map units are in this group. They make up about 42 percent of the survey area.

The soils in this group are dominantly near the coast. They are gently sloping to very steep. Elevation ranges from sea level to 1,700 feet. The vegetation is dominantly annual grasses, shrubs, and conifers.

These soils are shallow to very deep and are somewhat excessively drained to somewhat poorly drained. The surface layer is sand to clay loam.

This group is used mainly as rangeland and for recreation and wildlife habitat. Some areas are used as hayland and woodland and for urban development.

5. Dune land-Sirdrak

Dune land, and very deep, gently sloping to steep, somewhat excessively drained soils; on coastal dunes

This map unit is near Point Reyes and Dillons Beach. It is bordered by the Pacific Ocean. The soils in this unit formed dominantly in wind-blown deposits. Slope ranges from 2 to 50 percent. Elevation ranges from 5 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 53 to 56 degrees F, and the frost-free season is about 300 to 365 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Dune land, 20 percent Sirdrak soils, and 40 percent soils of minor extent.

Dune land is excessively drained, recent, wind-blown deposits. Most areas of Dune land support little if any vegetation.

Sirdrak soils are somewhat excessively drained, stabilized dunes. The surface layer is very dark grayish brown sand and is underlain by dark yellowish brown to yellowish brown sand.

Of minor extent in this unit are Beaches, Hydraquents, and Kehoe, Sirdrak Variant, and Tomales soils.

Most areas of this unit are used for recreation, wildlife habitat and rangeland. Some areas are used as woodland.

The major soils in this unit have very low available water capacity; therefore, they are suited only to drought-tolerant plants. The soils are also subject to soil blowing where barren.

This unit provides habitat for deer, California valley quail, dove, rabbits, rodents, birds of prey, and songbirds. Permanent vegetation, such as berry vines and lupine, left along the borders of fields and fence rows enhances the wildlife habitat. Existing windbreaks of cypress and pine and natural clumps of shrubs provide habitat and protection from ocean winds. Management practices that enhance wildlife habitat include proper grazing use, providing drinking water, and preserving the clumps of shrubs.

6. Kehoe-Sheridan Variant

Moderately deep, strongly sloping to very steep, well drained soils underlain by sandstone and quartz-diorite; on hills

This map unit is on Tomales Point and in the Inverness area on the west side of the San Andreas fault. The unit is adjacent to Tomales Bay and the Pacific Ocean. The soils in this unit formed in residuum derived from sandstone and quartz-diorite. Slope ranges from 9 to 75 percent. Elevation ranges from 20 to 1,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the frost-free season is 300 to 365 days.

This unit makes up about 4 percent of the survey area. It is about 30 percent Kehoe soils, 30 percent Sheridan Variant soils, and 40 percent soils of minor extent.

Kehoe soils are moderately deep and well drained. Slope ranges from 9 to 30 percent. The surface layer is

very dark grayish brown loam. The underlying material is very pale brown loam over weathered, soft sandstone.

Sheridan Variant soils are moderately deep and well drained. Slope ranges from 9 to 75 percent. The surface layer is brown coarse sandy loam. The underlying material is strong brown coarse sandy loam over weathered quartz-diorite.

Of minor extent in this unit are Inverness, Kehoe Variant, and Sirdrak soils and Rock outcrop.

Most areas of this unit are used for recreation, rangeland, and wildlife habitat. Some areas are used as homesites and woodland.

This unit is limited by steepness of slope, depth to rock, the hazard of erosion, and restricted available water capacity.

This unit is limited for septic tank absorption fields by depth to rock, slope, and the potential for seepage. Special design of absorption fields is needed.

This unit supports extensive stands of bishop pine interspersed with areas dominated by grasses and shrubs. The unit provides excellent habitat for deer, band-tailed pigeon, California valley quail, dove, rabbits, rodents, bobcat, fox, birds of prey, and songbirds. Drinking water for wildlife is scarce on this unit because of its higher lying position, the absence of streams, and the scarcity of springs and seeps. Management practices that enhance wildlife habitat include prescribed burning and providing drinking water.

7. Palomarin-Wittenberg

Deep, strongly sloping to very steep, well drained soils underlain by siliceous shale and sandstone; on hills and mountains

This map unit is west of the San Andreas fault. The soils formed in residuum derived from siliceous sandstone and shale. Slope ranges from 9 to 75 percent. Elevation ranges from 500 to 1,300 feet. The mean annual precipitation is 30 to 42 inches, the mean annual air temperature is 53 to 58 degrees F, and the frost-free season is 300 to 365 days.

This unit makes up about 3 percent of the survey area. It is about 35 percent Palomarin soils, 30 percent Wittenberg soils, and 35 percent soils of minor extent.

The surface layer of the Palomarin soils is dark grayish brown loam. The underlying material is grayish brown and brown loam over hard, highly fractured siliceous shale and sandstone.

The surface layer of the Wittenberg soils is dark grayish brown very gravelly loam. The underlying material is yellowish brown and brown very gravelly loam over hard, highly fractured siliceous shale.

Of minor extent in this unit are well drained Bayview, Pablo, and Inverness soils.

Most areas of this unit are in the Point Reyes National Seashore Wilderness Area. These areas are used for recreational development, such as hiking paths and bridle paths and for wildlife habitat. The unit is limited mainly by steepness of slope.

This unit supports Douglas-fir and extensive brush. It provides habitat for deer, band-tailed pigeon, dove, rodents, fox, bobcat, birds of prey, and songbirds. Occasional streams, seeps, and springs provide drinking water for wildlife. Prescribed burning enhances wildlife habitat on this unit.

8. Pablo-Bayview

Shallow, moderately steep to very steep, well drained soils underlain by siliceous shale and sandstone; on uplands

This map unit is west of the San Andreas fault, in the Point Reyes National Seashore. It is adjacent to the Pacific Ocean. The soils formed in residuum derived from siliceous shale and sandstone. Slope ranges from 15 to 75 percent. Elevation ranges from 100 to 700 feet. The mean annual precipitation is about 25 to 35 inches, the mean annual air temperature is about 52 to 57 degrees F, and the frost-free season is about 300 to 365 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Pablo soils, 30 percent Bayview soils, and 30 percent soils of minor extent.

The Pablo soils are dark gray loam underlain by hard, highly fractured siliceous shale.

The Bayview soils are dark grayish brown very gravelly loam underlain by hard, highly fractured siliceous shale and sandstone.

Of minor extent in this unit are well drained Inverness and Kehoe Variant soils, somewhat excessively drained Sirdrak soils, poorly drained Rodeo soils, and Rock outcrop.

Most areas of this unit are used for recreation and wildlife habitat. Some areas are used for livestock grazing.

This unit is limited by shallow soil depth and steepness of slope.

This unit supports extensive brush interspersed with occasional clumps of pine and small areas of grasses. The unit provides excellent habitat for deer, band-tailed pigeon, California valley quail, dove, rabbits, bobcat, fox, songbirds, and birds of prey. Several small ponds, intermittent streams, and springs and seeps provide drinking water and habitat for fish. The intermittent streams support extensive areas of diverse streamside vegetation. The ponds provide habitat and resting areas for shore birds and waterfowl. Management practices that enhance wildlife habitat include prescribed burning and maintaining existing ponds.

9. Cronkhite-Dipsea-Centissima

Moderately deep and deep, strongly sloping to very steep, moderately well drained and well drained soils underlain by sandstone and shale; on uplands

This map unit is east of the San Andreas fault, from Mount Tamalpais to Olema. It is in the Golden Gate Recreational Area. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 9 to 75 percent. Elevation ranges from 50 to 1,700 feet. The mean annual precipitation is about 30 to 50 inches, the mean annual air temperature is 50 to 57 degrees F, and the frost-free season is about 275 to 360 days.

This unit makes up about 8 percent of the survey area. It is about 20 percent Cronkhite soils, 20 percent Dipsea soils, 20 percent Centissima soils, and 40 percent soils of minor extent.

Cronkhite soils are deep and moderately well drained. Slope ranges from 9 to 75 percent. The surface layer is brown loam. The subsoil is yellowish brown and strong brown clay underlain by weathered sandstone and shale.

Dipsea soils are deep and well drained. Slope ranges from 30 to 75 percent. The surface layer is dark brown very gravelly loam. The subsoil is brown very gravelly clay loam underlain by weathered sandstone and shale.

Centissima soils are moderately deep and well drained. Slope ranges from 15 to 75 percent. The surface layer is brown loam. The subsoil is light yellowish brown loam. The substratum is light brown gravelly clay loam over weathered sandstone and shale.

Of minor extent in this unit are well drained Barnabe, Henneke, and Tocaloma soils and some areas of soils that have slipped.

Most areas of this unit are used for recreation, wildlife habitat, watershed, and urban development. Some areas are used as rangeland.

This unit is limited by steepness of slope, the hazard of erosion, and the hazard of slippage of the Cronkhite soils.

This unit supports extensive stands of Douglas-fir, redwood, and California laurel interspersed with open grassy areas. The unit provides excellent habitat for deer, band-tailed pigeon, California valley quail, dove, rabbits, rodents, bobcat, songbirds, and birds of prey. Occasional springs and seeps provide drinking water for wildlife. Management practices that enhance wildlife habitat include prescribed burning, providing drinking water, and proper grazing use.

10. Tamalpais-Barnabe Variant

Shallow and moderately deep, moderately steep to very steep, well drained soils underlain by chert and sandstone; on uplands

This map unit is near the Golden Gate Headlands. The soils in this unit formed in residuum derived from chert and sandstone. Slope ranges from 15 to 75 percent. Elevation ranges from 40 to 800 feet. The average annual precipitation is about 25 to 35 inches, the average annual air temperature is about 50 to 56 degrees F, and the average frost-free season is about 300 to 365 days.

This unit makes up about 2 percent of the survey area. It is about 35 percent Tamalpais soils, 25 percent Barnabe Variant soils, and 40 percent soils of minor extent.

Tamalpais soils are moderately deep and well drained. The surface layer is dark brown very gravelly loam. The subsoil is brown and dark reddish brown very gravelly clay and clay loam underlain by hard, highly fractured chert and sandstone.

Barnabe Variant soils are shallow and well drained. The surface layer is dark reddish brown very gravelly loam underlain by hard, highly fractured chert.

Of minor extent in this unit are well drained Cronkhite and Barnabe soils and poorly drained Rodeo soils.

Most areas of this unit are used for recreation and wildlife habitat. Some areas are used for urban development.

This unit is limited by shallow and moderate soil depth, restricted available water capacity, steepness of slope, and a potential for seepage.

The vegetation on this unit is dominated by close-growing shrubs and annual grasses. Occasional trees are in areas inland. The unit provides habitat for deer, California valley quail, dove, rabbits, rodents, songbirds, and birds of prey. A few small farm ponds, intermittent and perennial streams, springs, and seeps provide water for fish and wildlife. Rodeo Lagoon, which is intermittently connected to the ocean, is also on this unit. It provides brackish water for shore birds and waterfowl. Management practices that enhance wildlife habitat include prescribed burning, proper grazing use, and preserving trees and streamside vegetation.

11. Tomales-Steinbeck

Deep, gently sloping to steep, moderately well drained and well drained soils underlain by soft sandstone; on uplands

This map unit is in the northwestern part of the survey area. It is bordered by saline bays and estuaries. The soils formed in residuum derived from soft sandstone. Slope ranges from 2 to 50 percent. Elevation ranges from sea level to 800 feet. The average annual precipitation is about 25 to 40 inches, the mean annual air temperature is about 52 to 57 degrees F, and the frost-free season is about 270 to 365 days.

This unit makes up about 13 percent of the survey area. It is about 55 percent Tomales soils, 20 percent Steinbeck soils, and 25 percent soils of minor extent.

Tomales soils are deep and moderately well drained. Slope ranges from 2 to 50 percent. The surface layer is brown loam, and the subsurface layer is pale brown to very pale brown clay loam. The subsoil is light brownish gray to pale yellow clay underlain by soft, weathered sandstone.

Steinbeck soils are deep and well drained. Slope ranges from 5 to 50 percent. The surface layer is dark

grayish brown loam, and the subsurface layer is very pale brown and pale brown loam. The upper part of the subsoil is grayish brown and light yellowish brown clay loam, and the lower part is yellow clay underlain by soft, weathered sandstone.

Of minor extent in this unit are well drained Barnabe, Sobega, and Tocaloma soils.

Most areas of this unit are used as rangeland. Some areas are used as nonirrigated cropland and for homesite development.

This unit is limited for most uses by steepness of slope and the hazard of erosion.

This unit provides habitat for deer, California valley quail, dove, rabbits, raccoon, skunk, pheasant, birds of prey, and songbirds. Permanent vegetation, such as berry vines and roses, left or planted along ditches, field borders, or fence rows improves food and cover for wildlife. Windbreaks of eucalyptus, Monterey cypress, and pine provide habitat for quail, dove, birds of prey, and songbirds. Farm ponds can be constructed to provide water for fish and wildlife, including waterfowl. Occasional springs are throughout the unit. Vegetation along intermittent streams in the unit consists of willow, berries, and California laurel. Management practices that enhance wildlife habitat include proper grazing use and providing drinking water near areas of protective cover.

12. Olompali-Soulajule-Felton Variant

Moderately deep and deep, gently sloping to very steep, somewhat poorly drained and well drained soils; on terraces and uplands

This map unit is on old terraces along the eastern edge of Tomales Bay. It is bordered by saline bays and estuaries. The soils in this unit formed in mixed alluvium and in residuum derived from sandstone and shale. Slope ranges from 2 to 75 percent. Elevation ranges from about sea level to 1,300 feet. The mean annual precipitation is 25 to 45 inches, the mean annual air temperature is about 53 to 58 degrees F, and the frost-free season is about 250 to 300 days.

This unit makes up about 6 percent of the survey area. It is about 30 percent Olompali soils, 15 percent Soulajule soils, 15 percent Felton Variant soils, and 40 percent soils of minor extent.

Olompali soils are deep and somewhat poorly drained. Slope ranges from 2 to 30 percent. The surface layer is grayish brown loam. The upper part of the subsoil is yellowish brown and brown clay, and the lower part is pale brown and light yellowish brown clay.

Soulajule soils are moderately deep and well drained. Slope ranges from 9 to 75 percent. The surface layer is reddish brown clay loam. The upper part of the subsoil is reddish brown gravelly clay, and the lower part is yellowish red very gravelly clay underlain by highly weathered sandstone.

Felton Variant soils are deep and well drained. Slope ranges from 9 to 75 percent. The surface layer is brown loam. The upper part of the subsoil is yellowish brown clay loam, and the lower part is strong brown clay underlain by soft, weathered shale.

Of minor extent in this unit are well drained Barnabe, Saurin, Tocaloma, and Yorkville soils.

Most areas of this unit are used as rangeland.

This unit is limited for most uses by steepness of slope, the hazard of erosion, and susceptibility of the soils to compaction. The Olompali soils are also limited by very slow permeability.

This unit provides habitat for deer, California valley quail, dove, rabbits, raccoon, skunk, pheasant, birds of prey, and songbirds. Permanent vegetation, such as berry vines and roses, left or planted along ditches, field borders, or fence rows provides food and cover for wildlife. Windbreaks of eucalyptus, cypress, and pine provide habitat for wildlife, including rookeries for shore birds, such as egrets and herons. Occasional springs and seeps are throughout the unit. Intermittent streams in the unit generally are associated with streamside vegetation that includes willow, berries, California laurel, and coyotebrush. Management practices that enhance wildlife habaitat include proper grazing use and providing drinking water near areas of protective cover.

Inland soils on uplands

Five map units are in this group. They make up about 43 percent of the survey area.

The soils in this group are in the central and eastern part of the survey area. These soils are gently sloping to very steep. Elevation ranges from 50 to 2,500 feet. The vegetation is dominantly annual grasses, hardwoods, and shrubs.

These soils are shallow and moderately deep and are somewhat excessively drained and well drained. The surface layer is loam or gravelly loam.

These soils are used mainly as rangeland. The areas adjacent to the San Pablo Bay are used for urban development.

13. Tocaloma-Saurin

Moderately deep, gently sloping to very steep, well drained soils underlain by sandstone and shale; on uplands

This map unit is in the central part of the survey area. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 2 to 75 percent. Elevation is 50 to 1,500 feet. The average annual precipitation ranges from 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free season is 270 to 330 days.

This unit makes up about 23 percent of the survey area. It is about 30 percent Tocaloma soils, 20 percent Saurin soils, and 50 percent soils of minor extent.

Tocaloma soils have a grayish brown loam surface layer. The subsoil is light yellowish brown very gravelly loam over sandstone and shale.

Saurin soils have a yellowish brown clay loam surface layer and subsoil underlain by sandstone.

Of minor extent in this unit are somewhat excessively drained Bonnydoon soils; well drained Gilroy, Gilroy Variant, Los Osos, and McMullin soils; and moderately well drained Yorkville soils.

Most areas of this unit are used as rangeland.

This unit is limited for most uses by steepness of slope, the hazard of erosion, and susceptibility of the soils to compaction.

This unit supports extensive stands of oak, California laurel, and Pacific madrone interspersed with annual grasses. The unit provides habitat for deer, California valley quail, band-tailed pigeon, dove, rabbits, songbirds, and birds of prey. A few farm ponds are in this unit, but drinking water is scarce because there are only a few springs and seeps. Management practices that enhance wildlife habitat include proper grazing use and providing drinking water for wildlife.

14. Los Osos-Bonnydoon

Shallow and moderately deep, gently sloping to very steep, well drained and somewhat excessively drained soils underlain by sandstone and shale; on uplands

This map unit is in the central part of the survey area. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 2 to 75 percent. Elevation ranges from 50 to 500 feet. The average annual precipitation is about 25 to 40 inches, the average annual air temperature is about 58 to 62 degrees F, and the average frost-free season is about 270 to 320 days.

This unit makes up about 6 percent of the survey area. It is about 45 percent Los Osos soils, 25 percent Bonnydoon soils, and 30 percent soils of minor extent.

Los Osos soils are moderately deep and well drained. Slope ranges from 5 to 50 percent. The surface layer is grayish brown loam. The subsoil is brown clay underlain by fractured, weathered shale and sandstone.

Bonnydoon soils are shallow and somewhat excessively drained. Slope ranges from 2 to 75 percent. The surface layer is grayish brown gravelly loam underlain by fractured, weathered sandstone.

Of minor extent in this unit are well drained Gilroy, McMullin, Saurin, and Tocaloma soils.

This unit is used mainly as rangeland. Some areas are used for recreation and urban development.

The major soils in this unit are limited for most uses by shallow soil depth, steepness of slope, and the hazard of erosion. Landslides are common on the Los Osos soils when they are wet.

This unit supports extensive annual grasses with groves of oak and California laurel and other scattered trees. The unit provides habitat for deer, California valley quail, dove, rabbits, songbirds, and birds of prey. Occasional springs and seeps are throughout the unit. Streamside vegetation generally is along intermittent streams in the unit. Management practices that enhance wildlife habitat include proper grazing use, providing drinking water, and maintaining brush, trees, and streamside vegetation.

15. Tocaloma-McMullin

Shallow and moderately deep, moderately steep to very steep, well drained soils underlain by sandstone and shale; on uplands

This map unit is east of the San Andreas fault. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 15 to 75 percent. Elevation ranges from 50 to 1,500 feet. The average annual precipitation ranges from 30 to 40 inches, the average annual air temperature is about 55 to 60 degrees F, and the average frost-free season is 290 to 330 days.

This unit makes up about 8 percent of the survey area. It is about 30 percent Tocaloma soils, 25 percent McMullin soils, and 45 percent soils of minor extent.

Tocaloma soils are moderately deep and well drained. The surface layer is grayish brown loam. The subsoil is light yellowish brown very gravelly loam underlain by weathered, fractured sandstone.

McMullin soils are shallow and well drained. The surface layer is grayish brown gravelly loam. The subsoil is light yellowish brown gravelly loam underlain by hard, fractured sandstone.

Of minor extent in this unit are well drained Bonnydoon, Gilroy, and Los Osos soils.

Most areas of this unit are used as rangeland.

The major soils in this unit are limited for most uses by the restricted available water capacity and steepness of slope.

This unit supports extensive groves of California laurel, oak, and Pacific madrone and occasional open areas of annual grasses. The unit provides habitat for deer, California valley quail, dove, band-tailed pigeon, songbirds, and birds of prey. Drinking water for wildlife is scarce on this unit because of its higher lying position, the absence of streams, and the scarcity of springs and seeps. Management practices that enhance wildlife habitat include proper grazing use and providing drinking water.

16. Maymen-Maymen Variant

Shallow and moderately deep, steep and very steep, somewhat excessively drained and well drained soils underlain by sandstone and shale; on uplands

This map unit is on the sides of Mount Tamalpais and in adjacent areas. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 30 to 75 percent. Elevation ranges from 500

to 2,500 feet. The average annual precipitation is about 36 to 52 inches, the average annual air temperature is about 52 to 59 degrees F, and the average frost-free season is about 250 to 300 days.

This map unit makes up about 4 percent of the survey area. It is about 30 percent Maymen soils and 15 percent Maymen Variant soils. The remaining 55 percent is soils of minor extent.

Maymen soils are shallow and somewhat excessively drained. The surface layer is pale brown gravelly loam underlain by hard, fractured sandstone.

Maymen Variant soils are moderately deep and well drained. The surface layer is light brown gravelly loam. The subsoil is strong brown to reddish brown gravelly clay underlain by hard, fractured sandstone.

Of minor extent in this unit are well drained Centissima, Dipsea, Henneke, McMullin, and Tocaloma soils and areas of Rock outcrop and Urban land.

Most areas of this unit are used for recreation. Some small areas are used for urban development.

The major soils of this unit are limited for most uses by steepness of slope, shallow soil depth, and restricted available water capacity.

This unit supports extensive brushy areas consisting of manzanita, chamise, and scrub oak. Intermittent streams traverse the unit and support occasional trees, such as California laurel. The unit provides excellent habitat for deer, California valley quail, dove, rabbits, bobcat, songbirds, and birds of prey. Management practices that enhance wildlife habitat include providing drinking water for wildlife and brush management.

17. Tocaloma-McMullin-Urban land

Moderately deep and shallow, well drained, moderately steep to very steep soils underlain by sandstone and shale, and Urban land; on uplands

This map unit is in the southeastern part of the county and extends from Sausalito to Novato. The soils in this unit formed in residuum derived from sandstone and shale. Slope ranges from 15 to 75 percent. Elevation ranges from 50 to 1,500 feet. The average annual precipitation is about 30 to 40 inches, and the average annual air temperature is 55 to 60 degrees F, and the average frost-free season is 290 to 330 days.

This unit makes up about 2 percent of the survey area. It is about 40 percent Tocaloma soils, 25 percent McMullin soils, 20 percent Urban land, and 15 percent soils of minor extent.

Tocaloma soils are moderately deep and well drained. The surface layer is grayish brown loam. The underlying material is light yellowish brown very gravelly loam over sandstone and shale.

McMullin soils are shallow and well drained. The surface layer is grayish brown gravelly loam. The subsoil is light yellowish brown gravelly loam over hard, fractured sandstone.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. Soils under these structures have been extensively graded and mixed or have been covered with fill material.

Of minor extent in this unit are Dipsea and Saurin soils.

This unit is used mainly as homesites. It is limited mainly by steepness of slope.

This unit supports groves of California laurel and live oak. There are small, scattered areas of annual grasses and forbs. Occasional intermittent streams traverse the unit. Few seeps are in the unit. This unit provides excellent habitat for deer, band-tailed pigeon, California valley quail, dove, rabbits, bobcat, fox, songbirds, and birds of prey. Irrigated landscaping plants and adequate spacing between dwellings enhance the value of the unit for wildlife habitat. Management practices beneficial to wildlife include proper grazing use and providing drinking water.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one of more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils and miscellaneous areas have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Inverness loam, 9 to 15 percent slopes, is one of several phases in the Inverness series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Cronkhite-Barnabe complex, 9 to 15 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary

to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Tocaloma-Saurin association, steep, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

101—Ballard gravelly loam, 2 to 9 percent slopes. This very deep, well drained soil is on alluvial fans and bench terraces. It formed in alluvium derived dominantly from sedimentary and igneous rock. Slopes are long and smooth. Areas are irregular in shape and are 5 to 500 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 10 to 300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 250 to 280 days.

Typically, the surface layer is brown gravelly loam about 19 inches thick. The upper 7 inches of the subsoil is brown gravelly clay loam, and the lower 39 inches is light brown gravelly clay loam.

Included in this unit are small areas of Clear Lake soils in depressional areas and Cortina soils along drainageways. Also included are small areas of soils that are similar to the Ballard soil but have a gravelly fine sandy loam surface layer.

Permeability of the Ballard soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly for oat hay. It is also used for livestock grazing.

This unit is suited to hay and pasture. It has few limitations. Grasses and legumes grow well if adequate fertilizer is used. Using management that maintains optimum vigor and quality of forage plants is a good practice. The average annual yield of oat hay is 2 tons per acre.

This unit is suited to livestock grazing. It has few limitations. The soil in the unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. The characteristic plant community on this unit is mainly soft chess, ripgut brome, and needlegrass.

This map unit is in capability unit IIIe-1 (14), nonirrigated.

102—Ballard-Urban land complex, 0 to 9 percent slopes. This map unit is on alluvial fans and bench terraces. Slopes are long and smooth. Areas are irregular in shape and are 100 to 600 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 10 to 300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 250 to 280 days.

This unit is 55 percent Ballard gravelly loam and 25 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blucher and Cole soils, Hydraquents, and Reyes soils at the lower end of slopes. Also included are small areas of soils that are similar to the Ballard soil but have a clayey subsoil. Included areas make up about 20 percent of the total acreage.

The Ballard soil is very deep and well drained. It formed in alluvium derived dominantly from sedimentary and igneous rock. Typically, the surface layer is brown gravelly loam about 19 inches thick. The upper 7 inches of the subsoil is brown gravelly clay loam, and the lower 39 inches is light brown gravelly clay loam.

Permeability of the Ballard soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. During the construction of buildings and roads, the upper part of the soil is graded and moved about. Except for these modifications, the profile is undisturbed. Runoff is rapid, and the hazard of water erosion is slight.

This unit is used for urban development.

This unit has few limitations for urban development; however, the hazard of siltation is high. It is highest while the soil is being developed for use as urban land. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Establishing and maintaining the plant cover in disturbed areas can be achieved by proper fertilizing, seeding, mulching, and shaping of the slopes. The subsoil of the Ballard soil has potential for shrinking and swelling. Concrete structures should be specially designed to overcome this limitation. This can be achieved by using a blanket of crushed rock and sand beneath the structure, by using a vapor barrier, or by increasing the strength of the concrete by prestressing or by using additional amounts of reinforcing steel. Removal of gravel and cobbles is needed for best results in landscaping, particularly for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability unit IIIe-1 (14), nonirrigated.

103—Barnabe very gravelly loam, 30 to 50 percent slopes. This shallow, well drained soil is on uplands. It formed in material derived from hard, fractured sandstone or shale. Slopes are complex. Areas are irregular in shape and are 10 to 230 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 1,700 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 275 to 360 days.

Typically, the surface layer is grayish brown and dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown very gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Saurin soils on convex side slopes, Cronkhite soils on concave side slopes, and soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock and are near ridgetops or are less than 35 percent gravel throughout. Also included are small areas of Rock outcrop on ridgetops and Barnabe soils that have slope of less than 30 percent.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is poorly suited to livestock grazing. The production of forage is limited by shallow soil depth and very low available water capacity. This unit is limited for livestock watering ponds and other water impoundments because of the depth to rock.

Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, ripgut brome, and wild oat.

This map unit is in capability subclass VIe (4, 15), nonirrigated.

104—Beaches. This map unit consists of areas along the Pacific Ocean that are sandy, stony, or rocky. Stony or rocky beaches are mainly at the mouth of drainageways and at the base of cliffs. Beaches are barren. They are partly covered during high tide and are exposed during low tide. During severe storms turbulent wave action completely covers the beaches and may drastically alter their shape and extent. Most beaches are littered with debris washed ashore during storms.

Beaches are unstable; they may change from sandy to stony or gravelly or the reverse during storms. Some beaches have outcroppings of bedrock that are surrounded by sand. These areas change more slowly than beaches made up entirely of sand or stones and gravel.

Beaches are used for recreation and esthetic value. They have very limited agricultural value and are poorly suited as building sites or for roads.

This map unit has not been assigned a capability classification.

105—Blucher-Cole complex, 2 to 5 percent slopes. This map unit is in basins and on alluvial fans. Areas are irregular in shape and are 5 to 250 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 61 degrees F, and the average frost-free period is 210 to 290 days.

This unit is 40 percent Blucher silt loam and 30 percent Cole clay loam. The Blucher soil is near drainageways, and the Cole soil is on basin rims and in depressional areas. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Clear Lake soils in depressional areas; Cortina soils along draingeways; soils that are similar to these Blucher and Cole soils but have slope of less than 2 percent; soils, near Point Reyes Station, that are similar to these Blucher and Cole soils but have a mean annual soil temperature of less than 59 degrees; soils that are similar to the Blucher soil but are 15 to 30 percent gravel; and well drained soils, at the upper end of slopes, that have mottles in the subsoil. Also included are small areas of soils that have a fine sandy loam surface layer and soils, near Valley Ford, that are light-colored sandy loam. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Blucher soil is very deep and somewhat poorly drained. It formed in alluvium derived from various kinds of rock. Typically, the surface layer is grayish brown silt loam about 7 inches thick. The upper 16 inches of the underlying material is brown and pale brown loam and silt loam, and the lower part to a depth of 60 inches or more is gray and grayish brown silty clay loam and clay loam. In some areas the surface layer is silty clay loam.

Permeability of the Blucher soil is moderate to a depth of 23 inches and slow below this depth. Available water capacity is high to very high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 3.5 to 5 feet from December to April. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to occasional, very brief periods of flooding from December to April.

The Cole soil is very deep and somewhat poorly drained. It formed in alluvium derived from various kinds of rock. Typically, the surface layer is 14 inches deep.

The upper part is gray clay loam about 5 inches thick, and the lower part is dark gray silty clay loam about 9 inches thick. The subsoil to a depth of 60 inches or more is dark gray or grayish brown silty clay. In some areas the surface layer is silty clay loam.

Permeability of the Cole soil is slow. Available water capacity is high to very high. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1.5 to 3 feet from November to May. Runoff is slow, and the hazard of water erosion is slight. The soil is subject to occasional, brief periods of flooding from November to May.

Most areas of this unit are used for livestock grazing and hay and pasture. A few areas are used as homesites and for recreation.

This unit is suited to livestock grazing. The production of forage is limited by susceptibility of the soil to compaction, poor tilth, the seasonal high water table, and occasional periods of flooding. If the range vegetation is seriously deteriorated, seeding is needed. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. The soils should not be grazed during periods of flooding. The characteristic plant community on the unit is mainly soft chess, blue wildrye, and burclover.

This unit is suited to hay and pasture. Using management that maintains optimum vigor and quality of forage plants is a good practice. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Excessive water on the surface can be removed by open drains or tile drains. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for homesite development, the main limitations are the potential of the Cole soil for shrinking and swelling, the seasonal high water table, and occasional periods of flooding. Dikes and channels that have outlets for floodwater can be used to protect the unit from flooding. Drainage is needed if roads and building foundations are constructed. Wetness can also be reduced by installing drain tile around footings. Excess water can be removed by using properly designed drainage ditches. Plants that tolerate a seasonal high water table and droughtiness should be selected unless drainage and irrigation are provided. Buildings and roads should be designed to offset the effects of shrinking and swelling of the Cole soil. The effects of shrinking and swelling can be minimized by using proper engineering design and by backfilling with material that has low shrink-swell potential.

Septic tank absorption fields do not function properly during rainy periods because of flooding, the high water table, and slow permeability. Use of community sewage disposal systems is an alternative.

This unit is poorly suited to recreational development. It is limited mainly by the seasonal high water table, the clayey surface layer, and occasional periods of flooding. Drainage should be provided for playgrounds, picnic areas, camp areas, and golf fairways. Erosion, dustiness, and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability unit IIIw-3 (14), nonirrigated.

106—Bonnydoon gravelly loam, 15 to 30 percent slopes. This shallow, somewhat excessively drained soil is on uplands. It formed in material derived from fractured sandstone. Slopes are complex. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 270 to 320 days.

Typically, the Bonnydoon soil is brown to grayish brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of soils, on ridgetops, that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock or are more than 35 percent gravel; Saurin soils on convex side slopes; Tocaloma soils that are under a canopy of hardwoods and are mainly on north-facing side slopes; and Bonnydoon soils that have slope of less than 15 percent. Also included are small areas of Rock outcrop and Felton Variant and Soulajule soils.

Permeability of this Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing, recreation, and homesite development.

This unit is poorly suited to livestock grazing. The production of forage is limited by the very low available water capacity and shallow depth. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, ripgut brome, and California oatgrass.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, shallow soil depth, and gravel. Slope restricts the use of areas of th

unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are steepness of slope and shallow depth. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being converted from openland to urban use. Cuts needed to provide essentially level building sites can expose bedrock. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

Extensive cutting and filling generally are required, and cut slopes are susceptible to erosion. Intensive and extensive runoff control measures are also needed. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

Removal of gravel and cobbles in disturbed areas is needed for best results in landscaping, particularly for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Slope and shallow soil depth are concerns in installing septic tank absorption fields. Absorption lines should be installed on the contour. Using sandy backfill for the trench and increasing the size of the absorption field help to compensate for the shallow depth. Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass VIe (15), nonirrigated.

107—Bonnydoon gravelly loam, 30 to 75 percent slopes. This shallow, somewhat excessively drained soil is on uplands. It formed in material derived from fractured sandstone. Slopes are complex. Areas are irregular in shape and are 10 to 400 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 270 to 320 days.

Typically, the Bonnydoon soil is brown to grayish brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of soils, on ridgetops, that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock; soils, near ridgetops, that are similar to the Bonnydoon soil but are more than 35 percent gravel; Bonnydoon soils that have slope of less than 30 percent; Saurin soils on side slopes; and Tocaloma soils that are under a canopy of hardwoods and are mainly on north-facing side slopes. Also included are small areas of Rock outcrop and Felton Variant and Soulajule soils.

Permeability of this Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for livestock grazing, recreation, and homesite development.

This unit is poorly suited to livestock grazing. The production of forage is limited by the very low available water capacity and shallow depth. Slope restricts access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Mechanical treatment is not practical because of the steepness of slope. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, ripgut brome, and California oatgrass.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, shallow soil depth, and gravel. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are steepness of slope and shallow depth. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being converted from openland to urban use. Cuts needed to provide essentially level building sites can expose bedrock. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

Extensive cutting and filling generally are required because of the steepness of slope. Cut slopes are susceptible to erosion. Intensive and extensive runoff control measures are also needed. Mulching, fertilizing, irrigation, and erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

Removal of gravel and cobbles in disturbed areas is needed for best results in landscaping, particularly for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Slope and shallow soil depth are concerns in installing septic tank absorption fields. Absorption lines should be installed on the contour. Using sandy backfill for the trench and increasing the size of the absorption field help to compensate for the shallow depth. Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass VIIe (15), nonirrigated.

108—Bonnydoon Variant-Gilroy-Gilroy Variant loams, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 35 to 500 acres in size. The native vegetation is mainly annual grasses and forbs with scattered oak trees. Elevation is 100 to 1,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 290 to 300 days.

This unit is 30 percent Bonnydoon Variant loam, 25 percent Gilroy loam, and 20 percent Gilroy Variant loam. The Bonnydoon Variant soil commonly is on convex knolls and ridges, the Gilroy soil is mainly on plane side slopes, and the Gilroy Variant soil commonly is on concave, lower lying side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bonnydoon soils on ridgetops, Saurin soils on side slopes, Tocaloma and McMullin soils on north-facing side slopes and ridgetops and in drainageways, Montara soils in the less sloping areas, and soils that are similar to the major soils in this unit but have slope of less than 30 percent. Also included are small areas of soils that have a clay loam or gravelly clay loam surface layer. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Bonnydoon Variant soil is shallow and well drained. It formed in material derived from andesite. Typically, the soil is brown loam about 18 inches deep over fractured andesite. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon Variant soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is high.

The Gilroy soil is moderately deep and well drained. It formed in material derived from andesite. Typically, the surface layer is brown loam about 12 inches thick. The subsoil is reddish brown and yellowish red clay loam and gravelly clay loam about 18 inches thick. Fractured andesite is at a depth of 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Gilroy soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is high.

The Gilroy Variant soil is deep and well drained. It formed in material derived from andesite. Typically, the surface layer is brown loam about 21 inches thick. The subsoil is brown gravelly clay loam about 24 inches thick. Fractured andesite is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Gilroy Variant soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is very rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It is also used for recreation.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and shallow depth. It is also limited by the low available water capacity of the Bonnydoon Variant soil. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Mechanical treatment practices are not practical because of the steepness of slope. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. Grazing should be delayed until the soils in the unit have drained sufficiently and are firm enough to withstand trampling by livestock. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. The unit is also limited by shallow soil depth and gravel on the Bonnydoon Variant soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIIe (15), nonirrigated.

109—Bressa Variant-McMullin Variant complex, 30 to 50 percent slopes. This map unit is on uplands. It formed in material derived from conglomerate. Slopes are complex. Areas are elongated in shape and are 10 to 600 acres in size. The native vegetation is mainly hardwoods with an understory of grasses, forbs, and brush. Elevation is 0 to 500 feet. The average annual precipitation is 20 to 30 inches, the average annual air

temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 45 percent Bressa Variant gravelly loam and 25 percent McMullin Variant gravelly sandy clay loam. The Bressa Variant soil is mainly on plane to concave side slopes, and the McMullin Variant soil is mainly on convex side slopes and hilltops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to the Bressa Variant soil but have more than 35 percent clay in the subsoil or are more than 40 inches deep to bedrock and small areas of Los Osos and Bonnydoon soils. Also included are areas of Bressa Variant and McMullin Variant soils that have slope of less than 30 percent, soils that have a surface layer of very gravelly loam or very gravelly sandy clay loam, and soils that are similar to the Bressa Variant and McMullin Variant soils but have a mean annual soil temperature of more than 59 degrees F. Included areas make up about 30 percent of the total acreage.

The Bressa Variant soil is moderately deep and well drained. It formed in material derived from conglomerate. Typically, the surface layer is brown gravelly loam about 4 inches thick. The upper 21 inches of the subsoil is brown gravelly sandy clay loam, and the lower 5 inches is strong brown sandy clay loam. Weathered conglomerate is at a depth of 30 inches. Depth to conglomerate ranges from 20 to 40 inches.

Permeability of the Bressa Variant soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin Variant soil is shallow and well drained. It formed in material derived from conglomerate. Typically, the surface layer is brown gravelly sandy clay loam about 4 inches thick. The subsoil is light yellowish brown gravelly sandy clay loam about 10 inches thick. Weathered conglomerate is at a depth of 14 inches. Depth to conglomerate ranges from 10 to 20 inches.

Permeability of the McMullin Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing, homesite development, and recreation.

This unit is poorly suited to livestock grazing. The production of forage is limited by the canopy of hardwoods and steepness of slope. The unit is also limited by restricted rooting depth and very low and low available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the depth to rock.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Mechanical treatment practices are not practical because of the steepness of slope. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly California-laurel, blue oak, and dogtail.

If this unit is used for homesite development, the main limitations are steepness of slope and depth to rock. Cuts needed to provide essentially level building sites can expose bedrock. Excavation increases the risk of erosion. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Plans for homesite development should provide for the preservation of as many trees as possible. Removal of gravel and cobbles in disturbed areas is needed for best results in landscaping, particularly for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Septic tank absorption fields should be placed in the less sloping areas and in areas of the deeper Bresser Variant soil. Absorption lines should be placed on the contour. Increasing the size of the absorption field helps to compensate for the shallow depth of the McMullin soil.

If this unit is used for recreational development, the main limitations are steepness of slope, depth to rock, and gravel. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIe (15), nonirrigated.

110—Centissima-Barnabe complex, 15 to 30 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 80 to 450 acres in size. The native vegetation is mainly Douglas-fir, redwood, hardwoods, annual grasses, and forbs. Elevation is 500 to 1,700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Centissima loam and 20 percent Barnabe very gravelly loam. The Centissima soil is on side slopes and is under conifers, and the Barnabe soil is on ridgetops and side slopes and is under grasses. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Barnabe soils that have slopes of less than 15 percent; soils, near ridgetops, that are similar to the Barnabe soil but are less than 10 inches deep to bedrock; soils that are similar to the Centissima soil but are very gravelly throughout; Dipsea soils on north- and east-facing side slopes; Henneke soils under brush; and Rock outcrop on ridgetops. Also included are small areas of soils that are similar to the Centissima soil but have a clayey subsoil or are more than 40 inches deep to bedrock. Included areas make up about 30 percent of the total acreage.

The Centissima soil is moderately deep and well drained. It formed in material derived from weathered, soft sandstone or shale. Typically, the surface is covered with a mat of decomposed duff and litter about 2 inches thick. The surface layer is brown loam about 15 inches thick. The subsoil is light yellowish brown loam about 7 inches thick. The substratum is mainly light brown gravelly to very gravelly clay loam about 11 inches thick. Bedrock is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Centissima soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and watershed. Most of the unit is in the Golden Gate National Recreational Area.

The Centissima soil is suited to the production of Douglas-fir and redwood. On the basis of a site index of 200, it can produce about 15,850 cubic feet, or 92,500 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old. On the basis of a site index of 160, it can produce about 18,640 cubic feet, or 114,300 board feet (International rule, one-fourth inch kerf), of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old. The main concerns in producing and harvesting timber are the hazard of erosion, seedling mortality, and plant competition.

Conventional methods of harvesting timber generally can be used, but their use may be limited when the soil is wet. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are Douglas-fir and redwood.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability subclass IVe (15), nonirrigated.

111—Centissima-Barnabe complex, 30 to 50 percent slopes. This map unit is on uplands. Areas are irregular in shape and are 50 to 1,700 acres in size. The native vegetation is mainly Douglas-fir, redwood, hardwoods, ferns, annual grasses, and forbs. Elevation is 500 to 1,700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 275 to 365 days.

This unit is 50 percent Centissima loam and 20 percent Barnabe very gravelly loam. The Centissima soil is on side slopes, and the Barnabe soil is on ridgetops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Barnabe soils that have slope of less than 30 percent; soils, near ridgetops, that are similar to the Barnabe soil but are less than 10 inches thick; soils that are similar to the Centissima soil but are very gravelly throughout; Cronkhite soils under annual grasses; Dipsea soils on north- and east-facing side slopes; and Maymen and Maymen Variant soils under brush. Also included are small areas of soils that are similar to the Centissima soil but are more than 40 inches deep to bedrock, soils that are similar to the Centissima soil but have a clayey subsoil, Henneke soils, and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Centissima soil is moderately deep and well drained. It formed in material derived from weathered, soft sandstone or shale. Typically, the surface is covered with a mat of decomposed duff and litter about 2 inches thick. The surface layer is brown loam about 15 inches thick. The subsoil is light yellowish brown loam about 7 inches thick. The substratum is light brown gravelly to very gravelly clay loam about 11 inches thick. Bedrock is

at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Centissima soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and as watershed. Most of the unit is in the Golden Gate National Recreational Area.

The Centissima soil is suited to the production of Douglas-fir and redwood. On the basis of a site index of 200, it can produce about 15,850 cubic feet, or 92,500 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old. On the basis of a site index of 160, it can produce about 18,640 cubic feet, or 114,300 board feet (International rule, one-fourth inch kerf), of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, the hazard of erosion, seedling mortality, and plant competition. Steepness of slope restricts the kinds of equipment that can be used in forest management. Tractors can be used to harvest timber in the less sloping areas, but their use is limited in the steeper areas. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are redwood and Douglas-fir.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability subclass VIe (15), nonirrigated.

112—Centissima-Barnabe complex, 50 to 75 percent slopes. This map unit is on uplands. Areas are irregular in shape and are 25 to 1,700 acres in size. The native vegetation is mainly Douglas-fir, redwood, hardwoods, annual grasses, and forbs. Elevation is 500 to 1,700 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 275 to 365 days.

This unit is 40 percent Centissima loam and 20 percent Barnabe very gravelly loam. The Centissima soil is on side slopes and is under stands of Douglas-fir and redwood. The Barnabe soil is on ridgetops and side slopes and is under stands of brush and annual grasses. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima soils that have a gravelly loam or fine sandy loam surface layer; soils that are similar to the Centissima soil but are less than 40 inches deep to bedrock, are very gravelly throughout, or have a clayey subsoil; Dipsea soils on north-facing side slopes; Henneke and Maymen soils under brush; and Rock outcrop near ridgetops. Also included are small areas of soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock or average less than 35 percent gravel throughout the profile. Included areas make up about 40 percent of the total acreage.

The Centissima soil is moderately deep and well drained. It formed in material derived from weathered, soft sandstone or shale. Typically, the surface is covered with a mat of duff and litter about 2 inches thick. The surface layer is brown loam about 15 inches thick. The subsoil is light yellowish brown loam about 7 inches thick. The substratum is light brown gravelly to very gravelly clay loam about 11 inches thick. Bedrock is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Centissima soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for recreation and as watershed. Most of the unit is in the Golden Gate National Recreational Area.

The Centissima soil is suited to the production of Douglas-fir and redwood. On the basis of a site index of 200, it can produce about 15,850 cubic feet, or 92,500 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old. On the basis of a site index of 160, it can produce about 18,640 cubic feet, or 114,300 board feet (International rule, one-fourth inch kerf), of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, the hazard of erosion, seedling mortality, and plant competition. Steepness of slope restricts the kinds of equipment that can be used in forest management. Highlead or other cable logging methods can be used for harvesting timber; however, use of these methods is limited during November through April. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are Douglas-fir and redwood.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability subclass VIIe (15), nonirrigated.

113—Clear Lake clay. This very deep, poorly drained soil is in basins. It formed in fine-textured alluvium derived dominantly from sandstone or shale. Slopes are 0 to 2 percent. Areas are elongated in shape and are 15 to 350 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 1,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 200 to 300 days.

Typically, the surface layer is dark gray and very dark gray clay about 28 inches thick. The underlying material to a depth of 65 inches is dark gray and gray clay.

Included in this unit are small areas of overwash that has a clay loam or loam surface layer several inches thick. Also included are small areas of soils that are similar to the Clear Lake soil but that have slope of more than 2 percent and small areas of Blucher and Cole soils.

Permeability of this Clear Lake soil is slow. Available water capacity is moderate to high. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for livestock grazing. A few areas are used for hay and pasture.

The Clear Lake soil is suited to livestock grazing. The production of forage is limited by the seasonal high water table, slow permeability, and the hazard of flooding. This soil responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. The characteristic plant community on this soil is mainly soft chess, burclover, filaree, and wildrye.

The Clear Lake soil is suited to hay and pasture. The main limitations are the seasonal high water table, slow permeability, the clayey texture of the soil, and the hazard of flooding. The average yield per acre of oat hay is 3 tons. The use of equipment is limited by the clayey surface layer. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Fertility generally is sufficient for sustained production of high-quality nonirrigated pasture.

This map unit is in capability unit IIIw-5v (14), nonirrigated.

114—Cortina gravelly sandy loam, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on valley floors and along streams. It formed in alluvium derived from various kinds of rock. Slopes are nearly level to undulating. Areas are mainly elongated in shape and are 10 to 150 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 25 to 300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 60 to 64 degrees F, and the average frost-free period is 300 to 325 days.

Typically, the surface layer is light yellowish brown gravelly sandy loam about 10 inches thick. The upper 34 inches of the underlying material is light yellowish brown very gravelly sandy loam, and the lower part to a depth of 60 inches or more is pale brown gravelly loamy sand.

Included in this unit are small areas of soils that are similar to the Cortina soil but are less than 35 percent gravel throughout the profile, Ballard soils, and Clear Lake soils. Also included are areas of soils, south of Point Reyes Station, that are similar to the Cortina soil but have a darker surface layer that is loam to clay loam.

Permeability of this Cortina soil is rapid. Available water capacity is very low to low. Effective rooting depth

is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing.

The Cortina soil is poorly suited to livestock grazing. The production of forage is limited by low available water capacity and low soil fertility. The soil is limited for livestock watering ponds and other water impoundments because of the seepage potential. Livestock grazing should be managed to protect the soil from erosion. The characteristic plant community on this unit is mainly filaree, wild oat, and soft chess.

This map unit is in capability unit IVs-4 (14), nonirrigated.

115—Cronkhite-Barnabe complex, 9 to 15 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are narrow and elongated in shape and are 15 to 330 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 24 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 275 to 300 days.

This unit is 50 percent Cronkhite loam and 30 percent Barnabe very gravelly loam. Both Cronkhite and Barnabe soils are on convex side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Barnabe Variant and Tamalpais soils on rounded knolls, Cronkhite and Barnabe soils that have slope of less than 9 percent, Cronkhite soils that have slipped and are at the lower end of slopes, and soils that are similar to the Cronkhite soil but are less than 40 inches deep to bedrock or are on side slopes and do not have a clayey subsoil. Also included are small areas of soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock and small areas of Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Cronkhite soil is deep and moderately well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is brown and dark grayish brown loam about 26 inches thick. The upper 11 inches of the subsoil is yellowish brown and strong brown clay loam, and the lower 8 inches is yellowish brown clay loam. Bedrock is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Cronkhite soil is slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for recreation and livestock grazing. A few areas are used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by slope, the slow permeability of the Cronkhite soil, and the shallow depth of the Barnabe soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails.

This unit is suited to livestock grazing. The production of forage is limited by the very low available water capacity and the shallow depth of the Barnabe soil and the slow permeability of the Cronkhite soil. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. The characteristic plant community is mainly wild oat, soft chess, lupine, and coyotebrush on the Cronkhite soil, and it is soft chess, ripgut brome, and blue wildrye on the Barnabe soil.

This unit is suited to homesite development. The main limitations are slow permeability, potential for shrinking and swelling, susceptibility of the Cronkhite soil to slippage, and the shallow depth of the Barnabe soil. Cuts needed to provide essentially level building sites can expose bedrock. Drainage structures to divert runoff are needed if roads and building foundations are constructed. Excess water can be removed by using properly designed drainage ditches. Excavation increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If the unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field and by using long absorption lines and backfilling the trench with sandy material. Slope is also a concern in installing septic tank absorption fields. Absorption lines should be placed below the moderately slowly permeable layer and should be installed on the contour. If the density of housing is moderate to high, a

community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass IIIe (15), nonirrigated.

116—Cronkhite-Barnabe complex, 15 to 30 percent slopes. This map unit is on convex side slopes and ridgetops of hilly uplands. Slopes are complex. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 24 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 275 to 300 days.

This unit is 50 percent Cronkhite loam and 30 percent Barnabe very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Dipsea soils on north-facing side slopes and in drainageways; Cronkhite and Barnabe soils that have slope of less than 15 percent; Maymen and Maymen Variant soils on side slopes; soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock or are not gravelly; Cronkhite soils that have slipped and are at the lower end of slopes; and soils that are similar to the Cronkhite soil but are less than 40 inches deep to bedrock. Also included are small areas of Henneke soils, near Mount Tamalpais; soils on side slopes that are similar to the Cronkhite soil but do not have a clayey subsoil; and Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Cronkhite soil is deep and moderately well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is brown and dark grayish brown loam about 26 inches thick. The upper 11 inches of the subsoil is yellowish brown and strong brown clay loam, and the lower 8 inches is yellowish brown clay loam. Bedrock is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Cronkhite soil is slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for recreation and livestock grazing. A few areas are used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, the slow permeability of the Cronkhite soil, and the shallow depth of the Barnabe soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope. The unit is also limited by the low available water capacity and the shallow depth of the Barnabe soil and the slow permeability of the Cronkhite soil. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Grazing should be delayed until the soils are firm enough to withstand grazing pressure. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. The characteristic plant community is mainly wild oat, soft chess, lupine, and coyotebrush on the Cronkhite soil, and it is soft chess, ripgut brome, blue wildrye, and purple needlegrass on the Barnabe soil.

This unit is poorly suited to homesite development. The main limitations are steepness of slope, restricted permeability, potential for shrinking and swelling, and slippage of the Cronkhite soil and the shallow depth of the Barnabe soil. Cuts needed to provide essentially level building sites can expose bedrock. Drainage is needed if roads and building foundations are constructed. Excess water can be removed by using properly designed drainage ditches.

Excavation increases the risk of erosion. Steepness of slope presents many problems if the soils are used for homesite development. Extensive cutting and filling generally are required, and cut slopes are susceptible to erosion. Intensive and extensive runoff control measures are also needed.

Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. Cutbanks are not stable and are subject to slumping.

If the soils in this unit are used for septic tank absorption fields, the limitation of moderately slow

permeability can be overcome by increasing the size of the absorption field and by using long absorption lines and backfilling the trench with sandy material. Absorption lines should be placed below the moderately slowly permeable layer. Slope is also a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass IVe (15), nonirrigated.

117—Cronkhite-Barnabe complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 60 to 1,000 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 24 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 275 to 300 days.

This unit is 40 percent Cronkhite loam and 30 percent Barnabe very gravelly loam. The soils are on convex and concave side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Dipsea soils on north-facing side slopes and in drainageways; Cronkhite and Barnabe soils that have slope of less than 30 percent; Cronkhite soils that have slipped and are at the lower end of slopes; Maymen and Maymen Variant soils on side slopes; and soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock or average less than 35 percent gravel throughout the profile. Also included are small areas of soils that are similar to the Cronkhite soil but are less than 40 inches deep to bedrock and a few small areas of Rock outcrop. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Cronkhite soil is deep and moderately well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is brown and dark grayish brown loam and clay loam about 26 inches thick. The upper 11 inches of the subsoil is yellowish brown and strong brown clay loam, and the lower 8 inches is yellowish brown clay loam. Bedrock is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Cronkhite soil is slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for recreation and livestock grazing. A few areas are used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, the slow permeability of the Cronkhite soil, and shallow soil depth and gravel on the Barnabe soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope, the very low available water capacity and shallow depth of the Barnabe soil, and the slow permeability of the Cronkhite soil. The main limitations for seeding are steepness of slope and the shallow soil depth and low available water capacity of the Barnabe soil. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. The characteristic plant community is mainly wild oat, soft chess, lupine, and coyotebrush on the Cronkhite soil, and it is mainly soft chess, ripgut brome, and blue wildrye on the Barnabe soil.

This unit is poorly suited to homesite development. The main limitations are steepness of slope, restricted permeability, potential for shrinking and swelling, slippage of the Cronkhite soil, and the shallow depth of the Barnabe soil. Cuts needed to provide essentially level building sites can expose bedrock. Drainage and structures to divert runoff are needed if roads and building foundations are constructed. Excess water can be removed by using properly designed drainage ditches. Excavation increases the risk of erosion. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering design and by backfilling with material that has low shrink-swell potential.

The soils in this unit are limited for septic tank absorption fields by restricted permeability. Absorption lines should be placed below the layer that has restricted permeability. Slope is also a concern in installing septic

tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIe (15), nonirrigated.

118—Cronkhite-Barnabe complex, 50 to 75 percent slopes. This map unit is on mountainous uplands. Slopes are complex. Areas are irregular in shape and are 35 to 1,000 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 24 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 275 to 300 days.

This unit is 40 percent Cronkhite loam and 30 percent Barnabe very gravelly loam. The soils are on concave and convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Dipsea soils on north-facing side slopes and in drainageways; Maymen and Maymen Variant soils on side slopes; Cronkhite and Barnabe soils that have slope of less than 50 percent; areas of Cronkhite soils that have slipped; areas of soils that are similar to the Barnabe soil but are less than 10 inches deep to bedrock or average less than 35 percent gravel throughout the profile; and areas of soils that are similar to the Cronkhite soil but are less than 40 inches deep to bedrock. Also included are small areas of Rock outcrop. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Cronkhite soil is deep and moderately well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is brown and dark grayish brown loam and clay loam about 26 inches thick. The upper 11 inches of the subsoil is yellowish brown and strong brown clay loam, and the lower 8 inches is yellowish brown clay loam. Bedrock is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Cronkhite soil is slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown gravelly loam about 8 inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for recreation and livestock grazing. A few areas are used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, the slow permeability of the Cronkhite soil, and the shallow soil depth and gravel on the Barnabe soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and by the very low available water capacity and the shallow depth of the Barnabe soil. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Mechanical treatment is not practical on this unit because of the steepness of slope. Livestock grazing should be managed to protect the unit from erosion. Areas where brush is managed by prescribed burning or by chemical methods may be subject to a higher risk of erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. The characteristic plant community is mainly wild oat, soft chess, lupine, and coyotebrush on the Cronkhite soil, and ripgut brome and soft chess on the Barnabe soil.

This unit is poorly suited to homesite development. The main limitations are steepness of slope, restricted permeability, potential for shrinking and swelling, slippage of the Cronkhite soil, and the shallow depth of the Barnabe soil. Cuts needed to provide essentially level building sites can expose bedrock. Drainage and structures to divert runoff are needed if roads and building foundations are constructed. Excess water can be removed by using properly designed drainage ditches. Excavation increases the risk of erosion. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. The effects of shrinking and swelling can be minimized by using proper engineering design and by backfilling with material that has low shrink-swell potential.

The soils in this unit are limited for septic tank absorption fields by restricted permeability. Absorption lines should be placed below the layer that has restricted permeability. Slope is also a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIIe (15), nonirrigated.

119—Dipsea-Barnabe very gravelly loams, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 400 acres in size. The native vegetation is mainly mixed conifers and hardwoods on the Dipsea soil and annual grasses, forbs, and brush on the Barnabe soil. Elevation

is 500 to 1,700 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 275 to 365 days.

This unit is 50 percent Dipsea very gravelly loam and 20 percent Barnabe very gravelly loam. The Dipsea soil commonly is on east- and north-facing side slopes and in moist drainageways, and the Barnabe soil is on ridges and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima, Maymen, Maymen Variant, and Tocaloma soils on side slopes; areas of soils, near the top of slopes, that are similar to the Barnabe soil but are less than 10 inches deep to bedrock; and areas of soils that are similar to the Dipsea soil but are less than 40 inches deep to bedrock or average less than 35 percent gravel throughout the profile. Also included are small areas of Henneke soils on ridgetops and a few small areas of soils that have stones on less than 5 percent of the surface. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Dipsea soil is deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface is covered with a mat of leaves and duff about 2 inches thick. The surface layer is dark brown very gravelly loam about 8 inches thick. The upper 17 inches of the subsoil is brown very gravelly clay loam and loam, and the lower 23 inches is light brown very gravelly loam. Fractured bedrock is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Dipsea soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown to dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown very gravelly loam about 8 inches thick. Fractured bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation, watershed, and woodland.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. The Barnabe soil is also limited by shallow depth. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope.

The Dipsea soil is suited to the production of Douglas-fir and coast redwood. On the basis of a site index of 182, it can produce about 14,640 cubic feet, or 79,460 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old. On the basis of a site index of 190, it can produce about 26,985 cubic feet, or 175,850 board feet (International rule, one-fourth inch kerf) of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, the hazard of erosion, plant competition, and seedling mortality. Steepness of slope restricts the kinds of equipment that can be used in forest management. Conventional methods of harvesting trees can be used in the more gently sloping areas, but their use is limited in the steeper areas. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are Douglas-fir and coast redwood.

This map unit is in capability subclass VIe (4), nonirrigated.

120—Dipsea-Barnabe very gravelly loams, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 1,200 acres in size. The native vegetation is mainly mixed hardwoods and conifers on the Dipsea soil and annual grasses, forbs, and brush on the Barnabe soil. Elevation is 500 to 1,700 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 275 to 365 days.

This unit is 50 percent Dipsea very gravelly loam and 20 percent Barnabe very gravelly loam. The Dipsea soil commonly is on east- and north-facing side slopes and in moist drainageways, and the Barnabe soil is on ridges and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima, Maymen, Maymen Variant, and Tocaloma soils on side slopes; areas of soils, near the top of slopes, that are similar to the Barnabe soil but are less than 10 inches deep to bedrock; areas of soils that are similar to the Dipsea soil but are less than 40 inches deep to bedrock or average less than 35 percent gravel throughout the profile; and areas of soils, on toe slopes, that are similar to the Dipsea soil but are more than 60 inches deep to

bedrock. Also included are small areas of Henneke soils on ridgetops and a few small areas of soils that have stones on less than 5 percent of the surface. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Dipsea soil is deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface is covered with a mat of leaves and duff about 2 inches thick. The surface layer is dark brown very gravelly loam about 8 inches thick. The upper 17 inches of the subsoil is brown very gravelly clay loam and loam, and the lower 23 inches is light brown very gravelly loam. Fractured bedrock is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Dipsea soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very high.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown to dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown very gravelly loam about 8 inches thick. Fractured bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used for recreation, watershed, and woodland.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. The Barnabe soil is also limited by shallow depth. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope.

The Dipsea soil is suited to the production of Douglas-fir and coast redwood. On the basis of a site index of 182, it can produce about 14,640 cubic feet, or 79,460 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old. On the basis of a site index of 190, it can produce about 26,985 cubic feet, or 175,850 board feet (International rule, one-fourth inch kerf) of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, the hazard of erosion, plant competition, and seedling mortality. Steepness of slope restricts the kinds of equipment that can be used in forest management. Highlead or cable logging methods can be used for harvesting timber. Use of these methods is limited during November through April. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are Douglas-fir and coast redwood.

This map unit is in capability subclass VIIe (4), nonirrigated.

121—Dipsea-Urban land-Barnabe complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 100 to 300 acres in size. The native vegetation is mainly mixed conifers, hardwoods, annual grasses, and forbs. Elevation is 500 to 1,700 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 56 degrees F, and the average frost-free period is 275 to 365 days.

This unit is 40 percent Dipsea very gravelly loam, 30 percent Urban land, and 20 percent Barnabe very gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima, Maymen, and Maymen Variant soils, Rock outcrop, and Dipsea soils that have slopes of less than 30 percent. Also included are small areas of Tocaloma soils and soils that are similar to the Dipsea soil but are less than 40 inches deep to bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Dipsea soil is deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is dark brown very gravelly loam about 8 inches thick. The subsoil is brown and light brown very gravelly clay loam about 40 inches thick. Bedrock is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Dipsea soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Urban land consists of areas covered by roads, driveways, houses, and parking lots. The material beneath structures and roads consists of highly fractured, weathered rock mixed with soil material. Runoff is rapid, and the hazard of water erosion is slight.

The Barnabe soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown to dark grayish brown very gravelly loam about 8 inches thick. The subsoil is very dark grayish brown very gravelly loam about 8

inches thick. Bedrock is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for homesite development.

This unit is poorly suited to homesite development; however, population growth has resulted in increased construction of homes on the unit. The main limitation is steepness of slope. The Barnabe soil is also limited by shallow depth. Cuts needed to provide essentially level building sites can expose bedrock. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being developed for urban use. Only the part of the site that is used for construction should be disturbed.

Steepness of slope presents many problems if the soils are used for homesite development. Extensive cutting and filling are generally required, and cut slopes are susceptible to erosion. Intensive and extensive runoff control measures are also needed. Preserving the existing plant cover during construction helps to control erosion. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Plans for homesite development should provide for the preservation of as many trees as possible.

Effluent from septic tank absorption fields can surface downslope and create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIIe (4), nonirrigated.

122—Dune land. Dune land consists of hummocks, mounds, and hills of loose sand blown from nearby beaches. It is extensive and is scattered along the coast of the Pacific Ocean at Point Reyes. Elevation ranges from 5 to 300 feet. Some areas are active and shifting, and other areas are partly stabilized by coastal sagebrush and grass.

The soil material of Dune land exhibits no profile development. Permeability of the loose sand is very rapid. Effective rooting depth is more than 60 inches. Water supplying capacity is about 3 inches.

Some small, low basins are surrounded by dunes that are wet most of the year. These areas are similar to Aquepts, seeped, but they commonly are sand or loamy sand throughout. They are covered mainly by wiregrass.

Dune land is used for recreation and wildlife habitat. It has little agricultural value. Some areas that are covered with grass are grazed, but most of the cover should be left to protect the areas from soil blowing. Plant cover also helps to stabilize dunes and prevent their further movement.

This map unit is in capability subclass VIIIe (15).

123—Felton Variant-Soulajule complex, 9 to 15 percent slopes. This map unit is on rolling uplands. Slopes are complex. Areas are irregular in shape and are 10 to 150 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 1,300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 260 to 300 days.

This unit is 40 percent Felton Variant loam and 40 percent Soulajule clay loam. The soils are on broad ridgetops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils, on north- and east-facing side slopes, that are under a canopy of hardwood trees; Felton Variant and Soulajule soils that have slope of less than 9 percent; very gravelly loamy soils, near the top of slopes, that are less than 20 inches deep to bedrock; and soils that are similar to the Soulajule soil but average less than 35 percent gravel. Also included are small areas of soils that are similar to the Felton Variant soil but are less than 40 inches deep to bedrock and areas of Felton Variant and Soulajule soils that have slipped. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Felton Variant soil is deep and well drained. It formed in material derived from shale or sandstone. Typically, the surface layer is brown loam about 23 inches thick. The upper 11 inches of the subsoil is yellowish brown clay loam, and the lower 13 inches is strong brown clay. Bedrock is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Felton Variant soil is moderately slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Soulajule soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is reddish brown clay loam about 17 inches thick. The upper 5 inches of the subsoil is reddish brown gravelly clay, and the lower 6 inches is yellowish red very gravelly clay. Bedrock is at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Soulajule soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. It has few limitations. Rangeland seeding is a suitable practice if the range vegetation is in poor condition. The main limitation for seeding is steepness of slope. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. The characteristic plant community is mainly wild oat and soft chess on the Felton Variant soil, and it is mainly wild oat and blue wildrye on the Soulajule soil.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

124—Felton Variant-Soulajule complex, 15 to 30 percent slopes. This map unit is on rolling uplands. Slopes are complex. Areas are irregular in shape and are 20 to 150 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 1,300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 260 to 300 days.

This unit is 40 percent Felton Variant loam and 40 percent Soulajule clay loam. The soils are on ridgetops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils, on north- and east-facing side slopes, that are under a canopy of hardwood trees; Olompali soils near the bottom of slopes; very gravelly loamy soils that are less than 20 inches deep to bedrock; soils, near Walker and Chilano Creeks, that are similar to these Felton Variant and Soulajule soils but have a mean annual soil temperature of more than 59 degrees F; and soils that are similar to the Felton Variant soil but are less than 40 inches deep to bedrock. Also included are small areas of Felton Variant and Soulajule soils that have slope of less than 15 percent, Rock outcrop near ridgetops, and areas of Soulajule soils that have slipped. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Felton Variant soil is deep and well drained. It formed in material derived from shale or sandstone. Typically, the surface layer is brown loam about 23 inches thick. The upper 11 inches of the subsoil is yellowish brown clay loam, and the lower 13 inches is strong brown clay. Bedrock is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Felton Variant soil is moderately slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Soulajule soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is reddish brown clay loam about 17 inches thick. The upper 5 inches of the subsoil is reddish brown gravelly clay, and the lower 6 inches is yellowish red very gravelly clay. Bedrock is at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Soulajule soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the restricted permeability and low to moderate available water capacity. Rangeland seeding is a suitable practice if the range vegetation is in poor condition. The main limitations for seeding are steepness of slope and restricted permeability.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. The characteristic plant community is mainly wild oat and soft chess on the Felton Variant soil, and it is mainly wild oat and blue wildrye on the Soulajule soil.

This map unit is in capability unit IV-3 (15), nonirrigated.

125—Felton Variant-Soulajule complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 1,300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 260 to 300 days.

This unit is 50 percent Felton Variant loam and 40 percent Soulajule clay loam. The soils are in convex and concave areas on ridgetops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma and McMullin soils on north- and east-facing side slopes, Olompali soils near the bottom of slopes on gently sloping terraces, Felton Variant and Soulajule soils that have slope of less than 30 percent, soils that are similar to the Felton Variant soil but are less than 40 inches deep to bedrock, soils that are similar to these Felton Variant and Soulajule soils but have a mean annual soil temperature of more than 59 degrees F, and very gravelly loamy soils, near ridgetops, that are less than 20 inches to bedrock. Also included are small areas of soils that are similar to the Soulajule soil but are less than 20 inches deep to bedrock and small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Felton Variant soil is deep and well drained. It formed in material derived from shale or sandstone. Typically, the surface layer is brown loam about 23 inches thick. The upper 11 inches of the subsoil is yellowish brown clay loam, and the lower 13 inches is strong brown clay. Bedrock is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Felton Variant soil is moderately slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Soulajule soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is reddish brown clay loam about 17 inches thick. The upper 5 inches of the subsoil is reddish brown gravelly clay, and the lower 6 inches is yellowish red very gravelly clay. Bedrock is at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Soulajule soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and slow permeability. Mechanical treatment practices are not feasible because of the steepness of slope.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. The characteristic plant community on the Felton Variant soil is mainly wild oat, soft chess, burclover, and plantain, and on the Soulajule soil it is wild oat, burclover, and needlegrass.

This map unit is in capability subclass IVe (15), nonirrigated.

126—Felton Variant-Soulajule complex, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 30 to 200 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 0 to 1,300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 260 to 300 days.

This unit is 50 percent Felton Variant loam and 40 percent Soulajule clay loam. These soils are on side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma and McMullin soils, on north- and east-facing side slopes, that are under a canopy of hardwood trees; very gravelly loamy soils that are less than 20 inches deep to bedrock; and soils that are similar to the Soulajule soil but average less than 35 percent gravel. Also included are small areas of Felton Variant and Soulajule soils that are eroded, soils that are similar to the Felton Variant soil but are less than 40 inches deep to bedrock, soils that are similar to the Soulajule soil but are less than 20 inches deep to bedrock, and Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Felton Variant soil is deep and well drained. It formed in material derived from shale and sandstone. Typically, the surface layer is brown loam about 23 inches thick. The upper 11 inches of the subsoil is yellowish brown clay loam, and the lower 13 inches is strong brown clay. Bedrock is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Felton Variant soil is moderately slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Soulajule soil is moderately deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is reddish brown clay loam about 17 inches thick. The upper 5 inches of the subsoil is reddish brown gravelly clay, and the lower 6 inches is yellowish red very gravelly clay. Bedrock is at a depth of 28 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Soulajule soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and restricted permeability. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Mechanical treatment practices are not feasible because of the steepness of slope. Grazing should be delayed until the soils are firm enough to withstand grazing pressure. The characteristic plant community on the Felton Variant soil is mainly wild oat, soft chess, burclover, and plantain, and on the Soulajule soil it is wild oat, burclover, and needlegrass.

This map unit is in capability unit VIIe (15), nonirrigated.

127—Fluvents, channeled. This map unit consists of erratically stratified layers of water deposited sand, gravel, stones, and cobbles. Layers of sandy loam and silt loam are deposited for short periods but are subject to intermittent scouring and removal. The strata are 2 to 30 inches thick. The unit is in active stream channels and on flood plains and is adjacent to drainageways. Slope is 0 to 5 percent. Elevation is 100 to 1,500 feet. The vegetation consists of occasional willows, water-tolerant grasses, and some brush.

The soil material in this unit is neutral or mildly alkaline. The organic matter content varies, but it commonly is low. The hazard of erosion is slight to very high. The unit is inundated during periods of waterflow and is subject to constant deposition and removal of material.

This map unit is in capability unit VIIw.

128—Gilroy-Gilroy Variant-Bonnydoon Variant loams, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 600 acres in size. The native vegetation is mainly annual grasses and forbs with scattered oak trees. Elevation is 100 to 1,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 250 to 300 days.

This unit is 35 percent Gilroy loam, 25 percent Gilroy Variant loam, and 20 percent Bonnydoon Variant loam. The Gilroy soil commonly is on plane side slopes, the Gilroy Variant soil commonly is on concave, lower side slopes, and the Bonnydoon Variant soil commonly is in convex areas on knolls and ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma and McMullin soils on knolls, on north-facing side slopes, and along drainageways; soils, on side slopes, that are similar to the Gilroy, Gilroy Variant, and Bonnydoon Variant soils but average more than 35 percent gravel; Montara soils at the lower end of slopes; and Gilroy, Gilroy Variant, and Bonnydoon Variant soils that have slope of less than 30 percent or more than 50 percent. Also included are small areas of soils that have a clay loam or gravelly clay loam surface layer and Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Gilroy soil is moderately deep and well drained. It formed in material derived from andesite. Typically, the soil is brown loam about 12 inches thick. The subsoil is reddish brown clay loam over very gravelly clay loam about 18 inches thick. Fractured andesite is at a depth of 30 inches. Depth to andesite ranges from 20 to 40 inches.

Permeability of the Gilroy soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate.

The Gilroy Variant soil is deep and well drained. It formed in material derived from igneous and metamorphic rock. Typically, the surface layer is brown loam about 21 inches thick. The subsoil is brown gravelly clay loam about 24 inches thick. Fractured andesite is at a depth of 45 inches. Depth to andesite ranges from 40 to 60 inches or more.

Permeability of the Gilroy Variant soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

The Bonnydoon Variant soil is shallow and well drained. It formed in material derived from andesite. Typically, the Bonnydoon Variant soil is brown loam about 18 inches deep over fractured andesite. Depth to andesite ranges from 10 to 20 inches.

Permeability of the Bonnydoon Variant soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing. It is also used for recreation.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and by the restricted rooting depth and low available water capacity of the Bonnydoon Variant soil. Rangeland seeding is a suitable practice if the range vegetation is in poor condition. The main limitations are steepness of slope and a few cobbles on the surface.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Livestock grazing should be managed to protect the unit from erosion. Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

These soils are poorly suited to recreational development. They are limited mainly by steepness of slope. Slope restricts the use of these soils mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIe (15), nonirrigated.

129—Henneke stony clay loam, 15 to 50 percent slopes. This shallow, somewhat excessively drained soil is on uplands. It formed in material derived from serpentinite. Slopes are complex. Areas are elongated and are 20 to 200 acres in size. The native vegetation is mainly brush, stunted trees, annual grasses, and forbs.

Elevation is 500 to 2,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 60 degrees F, and the average frost-free period is 230 to 250 days.

Typically, 50 percent of the surface is covered with stones. The surface layer is dark reddish brown stony clay loam about 3 inches thick. The upper 6 inches of the subsoil is dark reddish brown very cobbly clay loam, and the lower 7 inches is dark brown very cobbly clay. Fractured serpentinite is at a depth of 16 inches. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of soils that are similar to the Henneke soil but have a browner surface layer and a redder subsoil or are less than 10 inches deep to bedrock. Also included are small areas of Henneke soils that have slope of more than 50 percent.

Permeability of this Henneke soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and homesite development.

This unit is poorly suited to livestock grazing. The production of forage is limited by stones on the surface, shallow soil depth, and very low available water capacity. The soil is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the surface after grazing. The characteristic plant community on this unit is mainly buckbrush, chamise, manzanita, and leather oak.

If this unit is used for homesite development, the main limitations are steepness of slope, shallow depth to rock, and stones and cobbles. Cuts that are needed to provide essentially level building sites can expose bedrock. Topsoil can be stockpiled and used to reclaim exposed areas. Cutbanks are not stable and are subject to slumping. Control of runoff is needed to reduce erosion and slumping. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Removal of stones and cobbles is needed for best results in landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If this unit is used for septic tank absorption fields, the limitations of moderately slow permeability and shallow soil depth can be overcome by increasing the size of the absorption field and backfilling the trench with sandy material. Absorption lines should be placed on the contour. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water as a result of seepage from onsite sewage disposal systems.

This map unit is in capability subclass VIIs (15), nonirrigated.

130—Humaquepts, seeped. This map unit consists of nearly level to sloping, poorly drained soils in small drainageways. Typically, Humaquepts have 3 to 6 inches of sod on the surface. The sod is 50 percent or more peaty material. Below this is very dark gray or black loam, clay loam, or clay that is constantly wet. Many areas are subject to deposition of material blown from ocean beaches. These areas have a loamy sand surface layer and are loam or coarser in texture in the underlying material.

Humaquepts have a water table at or near the surface throughout winter and spring. During summer and fall, the water table is at a depth of 2 to 5 feet. The soils are wet as a result of seepage from higher areas. Deep gullies have developed in a few areas as a result of runoff.

Humaquepts are covered with wiregrass and other water-tolerant plants. They commonly are too wet for livestock grazing in winter or spring but are used for grazing late in summer and in fall. They are not suitable as building sites, for roads, or for recreation because of wetness.

This map unit is in capability subclass VIIw (15).

131—Hydraquents, saline. This map unit consists of nearly level soils along the coast. Typically, they are stratified deposits of silt and clay with thin layers of peat. The soils are mottled throughout and are continuously waterlogged. In most areas, these soils are covered by water during unusually high tides; and in some of the lower areas, they are covered daily. The soils are exposed periodically during unusually low tides. The soils are very saline. Some areas are barren, and other areas support salt-tolerant, water-loving plants.

Included in this unit are small areas of soils that are covered with sandy deposits.

The soils in this unit are very poorly drained. They have a high water table throughout the year. Surface runoff is very slow to ponded, and the hazard of erosion is slight.

This unit is used for tidal marsh wildlife habitat.

This map unit is in capability subclass VIIw (15).

132—Inverness loam, 9 to 15 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are smooth. Areas are irregular in shape and are 10 to 300 acres in size. The native vegetation is mainly annual grasses, forbs, brush, and scattered bishop pine. Elevation is 250 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown loam about 22 inches thick. The upper 7 inches of the subsoil is brown clay loam, and the lower 7 inches is light yellowish brown clay loam. The substratum is very pale brown loam about 24 inches thick over quartz-diorite. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Bayview and Pablo soils on rounded knolls; Palomarin, Sheridan Variant, and Wittenberg soils on north- and east-facing side slopes, Rock outcrop on ridgetops; and gravelly soils that are near the top of slopes and are less than 20 inches deep to bedrock. Also included are small areas of soils that are similar to the Inverness soil but are less than 40 inches deep to bedrock and Inverness soils that have slope of less than 9 percent.

Permeability of this Inverness soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used for recreation. A few areas are used for livestock grazing.

This soil is suited to recreational development. It is limited mainly by the steepness of the slope. The slope restricts the use of this soil mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. It has few limitations. The soil responds well to fertilizer, to rangeland seeding, and to proper grazing use. Brush management improves deteriorated rangeland that is producing more woody shrubs than were present in the characteristic plant community. The characteristic plant community is mainly common velvetgrass, California brome, western swordfern, and blackberry.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

133—Inverness loam, 15 to 30 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 5 to 100 acres in size. The native vegetation is mainly annual grasses, forbs, brush, and scattered bishop pine. Elevation is 250 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown loam about 22 inches thick. The upper 7 inches of the subsoil is brown clay loam, and the lower 7 inches is light yellowish brown clay loam. The substratum is very pale brown loam about 24 inches thick over quartz-diorite. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Bayview and Pablo soils on rounded knolls; Palomarin, Sheridan Variant, and Wittenberg soils on north- and east-facing side slopes; Rock outcrop on ridgetops; and gravelly soils that are less than 20 inches deep to bedrock and are near the top of slopes. Also included are small areas of soils that are similar to the Inverness soil but are less than 40 inches deep to bedrock and Inverness soils that have slope of less than 15 percent.

Permeability of this Inverness soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

Most areas of this unit are used for recreation. A few areas are used as rangeland.

This soil is poorly suited to recreational development. It is limited mainly by steepness of slope. The slope restricts the use of this soil mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. It has few limitations. The soil responds well to fertilizer, to rangeland seeding, and to proper grazing use. Brush management improves deteriorated rangeland that is producing more woody shrubs than were present in the characteristic plant community. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly common velvetgrass, California brome, western swordfern, and blackberry.

This map unit is in capability unit IVe-1 (15), nonirrigated.

134—Inverness loam, 30 to 50 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 135 to 350 acres in size. The native vegetation is mainly Douglas-fir, hardwoods, forbs, and annual grasses. Elevation is 250 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown loam about 20 inches thick. The upper 7 inches of the subsoil is brown clay loam, and the lower 7 inches is light yellowish brown clay loam. The substratum is very pale brown loam about 26 inches thick over quartz-diorite. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sheridan Variant, Palomarin, and Wittenberg soils. Also included are soils on side slopes that are similar to the Inverness soil but are less than 40 inches deep to bedrock. Also included are small areas of Rock outcrop and gravelly soils that are less than 20 inches deep to bedrock. These areas are mainly on ridgetops.

Permeability of this Inverness soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for recreation. A few areas are used for homesite development.

This soil is poorly suited to recreational development. It is limited mainly by steepness of slope. The slope restricts the use of this soil mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to the production of Douglas-fir and bishop pine. On the basis of a site index of 161, it can produce about 12,850 cubic feet, or 62,100 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting timber generally can be used, but their use may be limited when the soil is wet.

If site preparation is not adequate, competition from plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by properly preparing the site and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Among the trees that are suitable for planting is Douglas-fir.

If this unit is used for homesite development, the main limitation is steepness of slope. Erosion is a hazard in the steeper areas. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Plans for homesite development should provide for the preservation of as many trees as possible.

Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIe (15), nonirrigated.

135—Inverness loam, 50 to 75 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 30 to 1,000 acres in size. The native vegetation is mainly Douglas-fir, hardwoods, forbs, and annual grasses. Elevation is 250 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown loam about 20 inches thick. The upper 7 inches of the subsoil is brown clay loam, and the lower 7 inches is light yellowish brown clay loam. The substratum is very pale brown loam about 26 inches thick over quartz-diorite. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sheridan Variant, Palomarin, and Wittenberg soils and soils that are similar to the Inverness soil but are less than 40 inches deep to bedrock. Also included are small areas of Rock outcrop and gravelly soils that are less than 20 inches deep to bedrock. These areas are mainly on ridgetops.

Permeability of this Inverness soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is very rapid, and the hazard of water erosion is high.

Most areas of this unit are used for recreation. A few areas are used for homesite development.

This soil is poorly suited to recreational development. It is limited mainly by steepness of slope. The slope restricts the use of this soil mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to the production of Douglas-fir and bishop pine. On the basis of a site index of 161, it can produce about 12,850 cubic feet, or 62,100 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Conventional

methods of harvesting timber are difficult to use because of slope. Highlead or other cable logging methods can be used; however, use of these methods is limited from November through April.

If site preparation is not adequate, competition from plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by properly preparing the site and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Among the trees that are suitable for planting is Douglas-fir.

If this unit is used for homesite development, the main limitations are steepness of slope and depth to rock. Erosion is a hazard in the steeper areas. Cuts that are needed to provide essentially level building sites can expose bedrock. Structures to divert runoff are needed if buildings and roads are constructed. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Only the part of the site that is used for construction should be disturbed. Plans for homesite development should provide for the preservation of as many trees as possible.

Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIIe (15), nonirrigated.

136—Kehoe loam, 9 to 15 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material derived from sandstone. Slopes are complex. Areas are narrow and irregular in shape and are 25 to 700 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 40 to 400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 55 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown and dark grayish brown loam about 34 inches thick. The underlying material to a depth of 38 inches is very pale brown loam. Sandstone is at a depth of 38 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Kehoe soils that have slope of less than 9 percent, Kehoe Variant soils, Rock outcrop on ridgetops, Sirdrak soils near the Pacific Ocean and Tomales Bay, and poorly drained soils in narrow drainageways. Also included are small areas of soils that are similar to the Kehoe soil but are underlain by sandstone at a depth of less than 20 inches and soils that have a clay loam or clay subsoil.

Permeability of this Kehoe soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the moderate available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. If the shrubs are managed to create open areas, the soil in this unit produces a good stand of desirable grasses and forbs. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, blue wildrye, and coyotebrush.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

137—Kehoe loam, 15 to 50 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material derived from sandstone. Slopes are complex. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 40 to 400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 53 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown and dark grayish brown loam about 30 inches thick. The underlying material to a depth of 34 inches is very pale brown loam. Bedrock is at a depth of 34 inches. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Kehoe soils that have slope of less than 15 percent, Kehoe Variant soils, Rock outcrop on ridgetops, and Sheridan Variant and Sirdrak soils near the Pacific Ocean and Tomales Bay. Also included are small areas of soils that are similar to the Kehoe soil but are underlain by sandstone at a depth of less than 20 inches and soils that have a clay loam or clay subsoil.

Permeability of this Kehoe soil is moderately rapid. Available water capacity is moderate. Effective rooting

depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the moderate available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. If the shrubs are managed to create open areas, the soil in this unit produces a good stand of desirable grasses and forbs.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, blue wildrye, and coyotebrush.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability unit IVe-1 (15), nonirrigated.

138—Kehoe Variant coarse sandy loam, 9 to 15 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are narrow and irregular in shape and are 5 to 100 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 0 to 550 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is dark grayish brown coarse sandy loam about 41 inches thick. The underlying material to a depth of 49 inches is brown and very pale brown loamy coarse sand. Quartz-diorite is at a depth of 49 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Kehoe soils on convex side slopes, Sirdrak soils at the lower end of slopes, Rock outcrop on ridgetops, Kehoe Variant soils that have slope of less than 9 percent, and soils that are similar to the Kehoe Variant soil but are less than 40 inches deep to bedrock. Also included are soils that are similar to the Kehoe Variant soil but have a higher content of clay in the surface layer and subsoil and soils that have a clay loam or clay subsoil.

Permeability of this Kehoe Variant soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the low to moderate available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from excessive erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. The characteristic plant community on this unit is mainly soft chess, bush lupine, and ripgut brome.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

139—Kehoe Variant coarse sandy loam, 15 to 50 percent slopes. This deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 15 to 500 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 0 to 550 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 55 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is dark grayish brown coarse sandy loam about 41 inches thick. The underlying material to a depth of 49 inches is brown and very pale brown loamy coarse sand. Quartz-diorite is at a depth of 49 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Kehoe soils on convex side slopes, Sirdrak soils at the lower end of slopes, Rock outcrop on ridgetops, soils that are similar to the Kehoe Variant soil but are less than 40 inches deep to bedrock, Kehoe Variant soils that have slope of more than 50 percent, and soils that have a reddish brown clay subsoil.

Permeability of this Kehoe Variant soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and the low to moderate available water capacity, which tends to make the soil droughty. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is steepness of slope. Plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Management practices suited to the unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, bush lupine, and ripgut brome.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This map unit is in capability subclass VIe (15), nonirrigated.

140—Los Osos-Bonnydoon complex, 5 to 15 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular to elongated in shape and are 20 to 300 acres in size. The native vegetation is mainly annual grasses, forbs, and some shrubs. Elevation is 200 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 60 percent Los Osos loam and 25 percent Bonnydoon gravelly loam. The Los Osos soil is mainly on concave to plane side slopes, and the Bonnydoon soil is mainly on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Los Osos soils that have slipped, Tocaloma soils on north- and east-facing side slopes, Saurin soils on convex side slopes, Yorkville soils on concave side slopes, soils that are similar to this Los Osos soil but are more than 40 inches deep to bedrock, and soils that are similar to this Bonnydoon soil but are less than 10 inches deep to bedrock and are on rounded, convex side slopes. Also included are small areas of Rock outcrop on ridgetops and Los Osos soils that have a clay loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Los Osos soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown loam about 18 inches thick. The upper 5 inches of the subsoil is grayish brown clay loam, and the lower 15 inches is brown and yellowish brown clay. Fractured bedrock is at a depth of 38 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Los Osos soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of slippage is high when the soil is wet.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the Bonnydoon soil is grayish brown gravelly loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the shallow depth of the Bonnydoon soil and the restricted available water capacity. The main limitations for seeding are the shallow depth of the Bonnydoon soil, restricted available water capacity, and susceptibility of the Los Osos soil to slippage.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial

spraying for brush management. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

If this unit is used for recreational development, the main limitations are steepness of slope, the shallow depth of the Bonnydoon soil, and the slow permeability of the Los Osos soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

141—Los Osos-Bonnydoon complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 30 to 300 acres in size. The native vegetation is mainly annual grasses, forbs, and some brush. Elevation is 200 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 60 percent Los Osos loam and 20 percent Bonnydoon gravelly loam. The Los Osos soil is mainly on concave to plane side slopes, and the Bonnydoon soil is mainly on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Los Osos soils that have slipped, Tocaloma soils on north- and east-facing side slopes, Los Osos and Bonnydoon soils that have slope of less than 15 percent, Saurin soils on convex side slopes, Yorkville soils on concave side slopes, soils that are similar to this Los Osos soil but are more than 40 inches deep to bedrock or have a clay loam subsoil, and soils that are similar to this Bonnydoon soil but are less than 10 inches deep to bedrock. Also included are small areas of soils in the hills south of Novato that are similar to this Los Osos soil but have a lighter colored surface layer and small areas of soils near Burdell Mountain that average more than 35 percent gravel. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Los Osos soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown loam about 18 inches thick. The upper 5 inches of the subsoil is grayish brown clay loam, and the lower 15 inches is brown and yellowish brown clay. Fractured bedrock is at a depth of 38 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Los Osos soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of slippage is high when the soil is wet.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the Bonnydoon soil is grayish brown gravelly loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The main limitations for the production of forage and for seeding are the shallow depth of the Bonnydoon soil, restricted available water capacity, and susceptibility of the Los Osos soil to slippage. The main limitations for seeding are the restricted available water capacity and the shallow depth of the Bonnydoon soil and susceptibility of the Los Osos soil to slippage.

Management practices suited to this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

If this unit is used for recreational development, the main limitations are steepness of slope, the shallow depth of the Bonnydoon soil, and the slow permeability of the Los Osos soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability unit IVe-1 (15), nonirrigated.

142—Los Osos-Bonnydoon complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 500

acres in size. The native vegetation is mainly annual grasses, forbs, and some brush. Elevation is 200 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 60 percent Los Osos loam and 20 percent Bonnydoon gravelly loam. The Los Osos soil is mainly on concave to plane side slopes, and the Bonnydoon soil is mainly on convex side slopes and ridges. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Los Osos soils that have slipped, Tocaloma soils on north- and east-facing side slopes, Yorkville soils on concave side slopes, soils that are similar to the Los Osos soil but are more than 40 inches deep to bedrock or have a clay loam surface layer, soils that are similar to the Bonnydoon soil but are less than 20 inches deep to bedrock and are on rounded convex side slopes, Rock outcrop on ridgetops, and soils that are similar to the Los Osos and Bonnydoon soils but have slope of more than 50 percent. Also included are small areas of soils that are similar to this Los Osos soil but have a lighter colored surface layer and are south of Novato and small areas of soils that have a reddish clay subsoil and are in the eastern part of the county. Included areas make up about 20 percent of the total acreage.

The Los Osos soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown loam about 15 inches thick. The upper 7 inches of the subsoil is brown clay loam, and the lower 8 inches is pale brown clay. Fractured bedrock is at a depth of 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Los Osos soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of slippage is high when the soil is wet.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the Bonnydoon soil is grayish brown gravelly loam about 11 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the shallow depth of the Bonnydoon soil, restricted available water capacity, and susceptibility of the Los Osos soil to slippage. The main limitation for seeding is steepness of slope.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Mechanical treatment practices are not practical because of the steepness of slope. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, wild oat, and filaree.

If this unit is used for recreational development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow depth. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIe (15), nonirrigated.

143—Los Osos-Urban land-Bonnydoon complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 5 to 75 acres in size. The native vegetation is mainly annual grasses, forbs, brush, and oak. Elevation is 200 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 35 percent Los Osos clay loam, 35 percent Urban land, and 20 percent Bonnydoon gravelly loam. The Los Osos soil is mainly on concave to plane side slopes, and the Bonnydoon soil is mainly on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Saurin soils on convex side slopes, Henneke soils near the top of slopes, Tocaloma soils on north-facing side slopes and in drainageways, Los Osos soils that have slipped, and Rock outcrop near ridgetops. Also included are small areas of Los Osos and Bonnydoon soils that have slope of less than 15 percent, soils that are similar to this Los Osos soil but are more than 40 inches deep to bedrock, soils that are similar to this Bonnydoon soil but average less than 15 percent gravel, and Xerorthents. Included areas make up about 10 percent of the total acreage.

The Los Osos soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown clay loam about 18 inches thick. The upper 5 inches of the subsoil is grayish brown clay loam, and the

lower 15 inches is brown and yellowish brown clay. Fractured bedrock is at a depth of 38 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Los Osos soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of slippage is high when the soil is wet.

Urban land consists of areas covered by roads, driveways, houses, and parking lots. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is very rapid, and there is no hazard of water erosion.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the Bonnydoon soil is grayish brown gravelly loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for homesite development.

If this unit is used for homesite development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow soil depth, and the Los Osos soil is limited by susceptibility to slippage, slow permeability, and the potential for shrinking and swelling. Cuts needed to provide essentially level building sites can expose bedrock. Topsoil can be stockpiled and used to reclaim exposed areas. Cutbanks are not stable and are subject to slumping. Areas of fill are not suitable as a base for structures until the material is compacted so that subsidence is minimized.

Concrete structures should be designed to overcome the potential for shrinking and swelling. This can be achieved by using blankets of crushed rock and sand beneath the structures, by using vapor barriers, or by increasing the strength of the concrete by prestressing or by using additional amounts of reinforcing steel.

Erosion is a hazard in the steeper areas. Excavation increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. If buildings and roads are constructed, structures to divert runoff, adequate cut-slope grade, and shaping of slopes reduce the risk of erosion and slumping. Revegetating disturbed areas around construction sites as soon as possible also helps to control erosion. Plans for homesite development should provide for the preservation of as many trees as possible. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load. Roads and streets can be built if they are designed to compensate for the instability of the Los Osos soil.

If the soils in this unit are used for septic tank absorption fields, the limitations of shallow soil depth and slow permeability can be overcome by increasing the size of the absorption field and by using sandy backfill for the trench. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies.

This map unit is in capability unit IVe-1 (15), nonirrigated.

144—Los Osos-Urban land-Bonnydoon complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 65 acres in size. The native vegetation is mainly annual grasses, forbs, brush, and live oak. Elevation is 200 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 40 percent Los Osos clay loam, 30 percent Urban land, and 20 percent Bonnydoon gravelly loam. The Los Osos soil is mainly on concave to plane side slopes, and the Bonnydoon soil is mainly on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Saurin soils on convex side slopes, Henneke soils near the top of slopes, Tocaloma soils on north-facing side slopes and in drainageways, Los Osos soils that have slipped, soils that are similar to the Los Osos soil but are more than 40 inches deep to bedrock, soils that are similar to the Bonnydoon soil but average less than 15 percent gravel, Los Osos and Bonnydoon soils that have slope of less than 30 percent, Xerorthents, and Rock outcrop near ridgetops. Included areas make up about 10 percent of the total acreage.

The Los Osos soil is moderately deep and well drained. It formed in material derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown clay loam about 15 inches thick. The upper 5 inches of the subsoil is grayish brown clay loam, and the lower 10 inches is brown and yellowish brown clay. Fractured bedrock is at a depth of 30 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Los Osos soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of slippage is high when the soil is wet.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is rapid, and the hazard of water erosion is none.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone or shale. Typically, the Bonnydoon soil is grayish brown gravelly loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for homesite development.

If this unit is used for homesite development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow soil depth, and the Los Osos soil is limited by susceptibility to slippage, slow permeability, and the potential for shrinking and swelling. Cuts needed to provide essentially level building sites can expose bedrock. Topsoil can be stockpiled and used to reclaim exposed areas. Cutbanks are not stable and are subject to slumping. Areas of fill are not suitable as a base for structures until the material is compacted so that subsidence is minimized.

Concrete structures should be designed to overcome the potential for shrinking and swelling. This can be achieved by using blankets of crushed rock and sand beneath the structures, by using vapor barriers, or by increasing the strength of the concrete by prestressing or using additional amounts of reinforcing steel.

The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soils in this unit are being converted from openland to urban use. Extensive cutting and filling generally are required, and cut slopes are susceptible to erosion. Using structures to divert runoff, using adequate cut-slope grade, and shaping slopes reduce the risks of erosion and slumping. Preserving the existing plant cover during construction helps to control erosion. Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

Steepness of slope presents many problems if the soils are used for urban development. Intensive and extensive runoff control measures are needed. Buildings and roads should be designed to offset the limited ability of the soils to support a load. Roads and streets can be built if they are designed to compensate for the instability of the Los Osos soil.

If the soils in this unit are used for septic tank absorption fields, the limitations of shallow soil depth and slow permeability can be overcome by increasing the size of the absorption field and using sandy backfill for the trench. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies.

This map unit is in capability subclass VIe (15), nonirrigated.

145—Maymen-Maymen Variant gravelly loams, 30 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 1,000 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 500 to 2,500 feet. The average annual precipitation is 36 to 52 inches, the average annual air temperature is 52 to 59 degrees F, and the average frost-free period is 250 to 300 days.

This unit is 50 percent Maymen gravelly loam and 20 percent Maymen Variant gravelly loam. These soils are on long side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Centissima and Dipsea soils in canyons, soils that are similar to this Maymen soil but are less than 10 inches deep to bedrock and are on side slopes, Henneke soils and Rock outcrop on ridgetops, Tocaloma soils on north- and east-facing side slopes, and soils that are similar to the Maymen and Maymen Variant soils but average more than 35 percent gravel. Also included are small areas of Maymen and Maymen Variant soils that have slope of less than 30 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Maymen soil is shallow and somewhat excessively drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is pale brown gravelly loam about 12 inches thick over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Maymen soil is moderate. Available water capacity is very low. Effective rooting depth 1s 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Maymen Variant soil is moderately deep and well drained. It formed in material derived dominantly from sandstone. Typically, the surface layer is light brown gravelly loam about 4 inches thick. The upper 26 inches of the subsoil is mainly light brown and strong brown gravelly clay, and the lower 7 inches is reddish yellow gravelly clay. Sandstone is at a depth of 37 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Maymen Variant soil is slow. Available water capacity is low. Effective rooting depth is

20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation, watershed, and some urban development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and by the shallow depth of the Maymen soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are the shallow depth of the Maymen soil and steepness of slope. Cuts needed to provide essentially level building sites can expose bedrock. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soils in the unit are being converted from openland to urban use.

Extensive cutting and filling are generally required, and cut slopes are susceptible to erosion. Intensive and extensive runoff control measures and shaping of slopes are needed. Preserving the existing plant cover during construction helps to control erosion. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Removal of pebbles and cobbles is needed for best results in landscaping, particularly for lawns.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Using long absorption lines and backfilling the trench with sandy material help to compensate for the slow permeability of the Maymen Variant soil and the shallow depth of the Maymen soil.

Buildings and roads should be designed to offset the effects of shrinking and swelling of the Maymen Variant soil. These effects can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is in capability subclass VIIe (15), nonirrigated.

146—Montara clay loam, 15 to 30 percent slopes. This shallow, well drained soil is on hilly uplands. It formed in material derived dominantly from serpentinite. Slopes are complex. Areas are irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly annual grasses and forbs with occasional brushy plants and oak trees. Elevation is 100 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 57 to 62 degrees F, and the average frost-free period is 290 to 330 days.

Typically, the surface layer is dark grayish brown and very dark grayish brown clay loam about 13 inches thick. Fractured serpentinite is at a depth of 13 inches. Depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Yorkville soils derived from schist, Henneke soils derived from serpentinitic rock, and soils that are similar to this Montara soil but are less than 10 inches deep to bedrock or have a loam surface layer. Also included are small areas of Rock outcrop and areas of soils that have stones on the surface.

Permeability of this Montara soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

This unit is poorly suited to livestock grazing. The production of forage is limited by steepness of slope, restricted rooting depth, and very low available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the depth to rock. Mechanical treatment practices are not practical because of rock fragments on the surface in a few areas and steepness of slope. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly foxtail fescue, red brome, and chamise.

If this unit is used for recreational development, the main limitations are steepness of slope, shallow depth to rock, and gravel and a few stones and cobbles on the surface. Drainage should be provided for paths and trails. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIIs (15), nonirrigated.

147—Novato clay. This very deep, very poorly drained soil is in saltwater marshes along the edges of San Pablo Bay. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Slopes are irregular in shape and are 100 to 500 acres in size. The native vegetation is mainly cordgrass, saltgrass, and pickleweed. Elevation is 2 to 10 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 270 to 320 days.

Typically, the surface layer is light gray and gray clay about 15 inches thick. The upper 12 inches of the

underlying material is gray clay, and the lower part to a depth of 60 inches or more is gray and light gray clay.

Included in this unit are small areas of soils that are similar to this Novato soil but are strongly acid throughout. Also included are small areas of Novato soils that are east of San Rafael and have an overwash of loam or gravelly loam.

Permeability of this Novato soil is slow. Effective rooting depth is 60 inches or more for water-tolerant plants. A high water table is at or near the surface throughout the year. The soil is saturated during periods of high tide.

This unit is used for wildlife habitat. The native vegetation provides food and cover for waterfowl and other birds.

This map unit is in capability subclass VIIIw (14), nonirrigated.

148—Olompali loam, 2 to 9 percent slopes. This deep, somewhat poorly drained soil is on coastal terraces. It formed in alluvium derived from various kinds of rock. Slopes are smooth. Areas are irregular in shape and are 20 to 600 acres in size. The native vegetation is mainly annual grasses, forbs, and wiregrass. Elevation is 50 to 800 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 250 to 300 days.

Typically, the surface layer is grayish brown and pale brown loam about 13 inches thick. The upper 15 inches of the subsoil is yellowish brown and brown clay, and the lower 32 inches or more is pale brown and light yellowish brown gravelly clay and clay.

Included in this unit are small areas of soils that are similar to this Olompali soil but are less than 40 inches deep to bedrock, Olompali soils that have slope of less than 2 percent, and Felton Variant and Soulajule soils at the upper end of slopes. Also included are small areas of soils in drainageways and Rock outcrop.

Permeability of this Olompali soil is moderate to a depth of 13 inches and very slow below this depth. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the subsoil at times from December to March.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the seasonal perched water table and very slow permeability. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are the seasonal perched water table and very slow permeability. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, California oatgrass, and plantain.

This unit is poorly suited to recreational development. It is limited mainly by very slow permeability and the seasonal perched water table. Shaping and grading may be needed in areas used for playgrounds and camp and picnic areas. Cuts and fills should be seeded or mulched. Drainage should be provided to remove excess water.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

149—Olompali loam, 9 to 15 percent slopes. This deep, somewhat poorly drained soil is on coastal terraces. It formed in alluvium derived from various kinds of rock. Slopes are smooth. Areas are irregular in shape and are 10 to 600 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 250 to 300 days.

Typically, the surface layer is grayish brown and pale brown loam about 13 inches thick. The upper 15 inches of the subsoil is yellowish brown and brown clay, and the lower 32 inches or more is pale brown, brownish yellow, and light yellowish brown gravelly clay and clay.

Included in this unit are small areas of soils that are similar to this Olompali soil but are less than 40 inches deep to bedrock, Olompali soils that have slopes less than 9 percent, and Felton Variant and Soulajule soils at the upper end of slopes. Also included are small areas of soils in drainageways and Rock outcrop.

Permeability of this Olompali soil is moderate to a depth of 13 inches and very slow below this depth. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. Water is perched above the subsoil at times from December to March.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the seasonal perched water table and very slow permeability. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are the seasonal water table and very slow permeability. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, California oatgrass, and blue wildrye.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, very slow permeability, and the seasonal perched water table. Shaping and grading may be needed in areas used for playgrounds and in picnic and camp areas. Cuts and fills should be seeded or mulched. Drainage should be provided to remove excess water.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

150—Olompali loam, 15 to 30 percent slopes. This deep, somewhat poorly drained soil is on coastal terraces. It formed in alluvium derived from various kinds of rock. Slopes are complex. Areas are irregular in shape and are 20 to 450 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 50 to 800 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 250 to 300 days.

Typically, the surface layer is grayish brown and pale brown loam about 13 inches thick. The upper 15 inches of the subsoil is yellowish brown and brown clay, and the lower 32 inches or more is pale brown and light yellowish brown gravelly clay and clay.

Included in this unit are small areas of soils that are similar to this Olompali soil but are less than 40 inches deep to bedrock or have a clay loam surface layer and are on concave slopes, Olompali soils that have slopes of more than 50 percent, and Yorkville soils on concave side slopes. Also included are small areas of Felton Variant, Soulajule, and Tocaloma soils, soils in drainageways, and Rock outcrop.

Permeability of this Olompali soil is moderate to a depth of 13 inches and very slow below this depth. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. Water is perched above the subsoil at times from December to March.

This unit is used for livestock grazing and recreation.

This unit is suited to livestock grazing. The production of forage is limited by the seasonal perched water table and very slow permeability. The main limitations for seeding are steepness of slope, the seasonal perched water table, and very slow permeability. Slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, California oatgrass, and blue wildrye.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope, very slow permeability, and the seasonal perched water table. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Cuts and fills should be seeded or mulched.

This map unit is in capability unit IVe-3 (15), nonirrigated.

151—Pablo-Bayview complex, 15 to 50 percent slopes. This map unit is on uplands. Slopes are rounded. Areas are irregular in shape and are 25 to 300 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 100 to 700 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Pablo loam and 30 percent Bayview very gravelly loam. These soils are on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Inverness, Palomarin, and Wittenberg soils at the upper end of slopes; Rodeo soils in narrow drainageways; soils, near ridgetops, that are similar to these Pablo and Bayview soils but are less than 10 inches deep to bedrock; loamy soils that are more than 40 inches deep to bedrock; and Tomales fine sandy loam at the lower elevations. Also included are small areas of soils that have a clay loam or clay subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Pablo soil is shallow and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the soil is dark gray loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Pablo soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Bayview soil is shallow and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface layer is dark grayish brown very gravelly loam about 7 inches thick. The subsoil is dark gray very gravelly loam about 7 inches thick. Hard, highly fractured bedrock is at a depth of 14 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bayview soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing and as watershed.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and shallow depth. The Bayview soil is also limited by the content of gravel throughout the soil. Paths and trails should extend across the slope. Cuts and fills should be seeded or mulched.

This unit is poorly suited to livestock grazing. The production of forage is limited by shallow soil depth, the very low available water capacity, and brush encroachment. The unit is limited for livestock watering ponds and other water impoundments because of the steepness of slope and shallow depth.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly brackenfern and coyotebrush on the Pablo soil, and it is mainly coyotebrush and needlegrass on the Bayview soil.

This map unit is in capability subclass VIe (15), nonirrigated.

152—Pablo-Bayview complex, 50 to 75 percent slopes. This map unit is on uplands. Slopes are rounded. Areas are irregular in shape and are 10 to 700 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 100 to 700 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Pablo loam and 30 percent Bayview very gravelly loam. These soils are on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Inverness, Palomarin, and Wittenberg soils at the upper end of slopes; Rodeo soils in narrow drainageways; soils, near ridgetops, that are similar to these Pablo and Bayview soils but are less than 10 inches thick; loamy soils that are more than 40 inches deep to bedrock; and Tomales fine sandy loam at the lower elevations. Also included are small areas of soils that have a clay loam or clay subsoil. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Pablo soil is shallow and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the soil is dark gray loam about 15 inches deep over fractured bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Pablo soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Bayview soil is shallow and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface layer is dark grayish brown very gravelly loam about 7 inches thick. The subsoil is dark gray very gravelly loam about 7 inches thick. Hard, highly fractured bedrock is at a depth of 14 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bayview soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing and as watershed.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and shallow depth. The Bayview soil is also limited by the gravel content throughout the soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Cuts and fills should be seeded or mulched.

This unit is poorly suited to livestock grazing. The production of forage is limited by the very low available water capacity, shallow soil depth, brush encroachment, and steepness of slope. The unit is limited for livestock watering ponds and other water impoundments because of the slope and shallow depth.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Use of mechanical treatment practices is not feasible because of the steepness of slope. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly brackenfern and coyotebrush on the Pablo soil, and it is mainly coyotebrush and needlegrass on the Bayview soil.

This map unit is in capability subclass VIIe (15), nonirrigated.

153—Palomarin-Wittenberg complex, 9 to 15 percent slopes. This map unit is on uplands. Slopes are long and smooth. Areas are irregular in shape and are 10 to 40 acres in size. The native vegetation is mainly conifers and hardwoods. Elevation is 500 to 1,300 feet. The average annual precipitation is 30 to 42 inches, the

average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Palomarin loam and 30 percent Wittenberg very gravelly loam. These soils are on west-facing side slopes of ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayview and Pablo soils under brush, Inverness and Sheridan Variant soils on north- and east-facing side slopes, soils that are similar to these Palomarin and Wittenberg soils but are less than 40 inches deep to bedrock, and soils that have a clay loam subsoil. Also included are small areas of Palomarin and Wittenberg soils that have slope of less than 9 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Palomarin soil is deep and well drained. It formed in material derived from siliceous shale. Typically, the surface is covered with a mat of Douglas-fir needles about 2 inches thick. The surface layer is dark grayish brown and grayish brown loam about 29 inches thick. The underlying material is brown loam 12 inches thick. Siliceous shale is at a depth of 41 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Palomarin soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

The Wittenberg soil is deep and well drained. It formed in material derived from siliceous shale. Typically, the surface is covered with a mat of Douglas-fir needles about 4 inches thick. The surface layer is dark grayish brown very gravelly loam about 26 inches thick. The upper 11 inches of the underlying material is yellowish brown very gravelly loam, and the lower 13 inches is brown very gravelly loam. Siliceous shale is at a depth of 50 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Wittenberg soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used for recreation. Prior to acquisition by the National Park Service, it was used for timber production.

This unit is suited to recreational development. It is limited mainly by steepness of slope and gravel. Shaping and grading may be needed for camp and picnic areas. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, it can produce about 13,275 cubic feet, or 66,050 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. Conventional methods of harvesting timber generally can be used, but their use may be limited when the soil is wet. Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting is Douglas-fir.

This map unit is in capability unit IIIe-1 (4), nonirrigated.

154—Palomarin-Wittenberg complex, 15 to 30 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 100 acres in size. The native vegetation is mainly conifers and hardwoods. Elevation is 500 to 1,300 feet. The average annual precipitation is 30 to 42 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Palomarin loam and 30 percent Wittenberg very gravelly loam. These soils are on north- and east-facing side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayview and Pablo soils that are under brush and are on south- and west-facing side slopes, Inverness and Sheridan Variant soils on east-facing side slopes, soils that are similar to these Palomarin and Wittenberg soils but are less than 40 inches deep to bedrock, and soils that have a clay loam subsoil. Also included are small areas of Palomarin and Wittenberg soils that have slope of less than 15 percent. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Palomarin soil is deep and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface is covered with a mat of Douglas-fir needles about 2 inches thick. The surface layer is dark grayish brown and grayish brown loam about 29 inches thick. The underlying material is brown loam 12 inches thick. Siliceous shale is at a depth of 41 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Palomarin soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

The Wittenberg soil is deep and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface is covered with a mat of Douglas-fir needles about 4 inches thick. The surface layer is dark grayish brown very gravelly loam about 26 inches thick. The upper 11 inches of the underlying material is

yellowish brown very gravelly loam, and the lower 13 inches is brown very gravelly loam. Siliceous shale is at a depth of 50 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Wittenberg soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used for recreation.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, it can produce about 13,275 cubic feet, or 66,050 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, seedling mortality, and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. Conventional methods of harvesting timber generally can be used, but their use may be limited when the soil is wet.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting is Douglas-fir.

This map unit is in capability unit IVe-1 (4), nonirrigated.

155—Palomarin-Wittenberg complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly conifers and hardwoods. Elevation is 500 to 1,300 feet. The average annual precipitation is 30 to 42 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Palomarin loam and 30 percent Wittenberg very gravelly loam. These soils are on north- and east-facing side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayview and Pablo soils under brush, Inverness and Sheridan Variant soils on east-facing side slopes, soils that are similar to these Palomarin and Wittenberg soils but are less than 40 inches deep to bedrock, and soils that have a clay loam subsoil. Also included are small areas of Rock outcrop on ridgetops and soils that are similar to this Palomarin soil but have a gravelly loam surface layer. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Palomarin soil is deep and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface is covered with a mat of Douglas-fir needles about 2 inches thick. The surface layer is dark grayish brown and grayish brown loam about 18 inches thick. The underlying material is brown and grayish brown loam 23 inches thick. Siliceous shale is at a depth of 41 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Palomarin soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Wittenberg soil is deep and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface is covered with a mat of Douglas-fir needles about 4 inches thick. The surface layer is dark grayish brown very gravelly loam about 26 inches thick. The upper 11 inches of the underlying material is yellowish brown very gravelly loam, and the lower 13 inches is brown very gravelly loam. Siliceous shale is at a depth of 50 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Wittenberg soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for recreation.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This unit is suited to the production of Douglas-fir. On the basis of a site index at 165, it can produce about 12,850 cubic feet, or 62,100 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, seedling mortality, and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Proper design of a road drainage system and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Steepness of slope restricts the kinds of equipment that can be used in forest management. Tractors can be used in the more gently sloping areas, but their use is restricted in the

steeper areas. Use of tractors is limited during November through April. Highlead or other cable logging methods can be used.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting is Douglas-fir.

This map unit is in capability subclass VIe (4), nonirrigated.

156—Palomarin-Wittenberg complex, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 50 to 1,000 acres in size. The native vegetation is mainly conifers and hardwoods. Elevation is 500 to 1,300 feet. The average annual precipitation is 30 to 42 inches, the average annual air temperature is 53 to 58 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 40 percent Palomarin loam and 30 percent Wittenberg very gravelly loam. These soils are on north- and east-facing side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bayview and Pablo soils under brush, Inverness and Sheridan Variant soils on east-facing side slopes, soils that are similar to these Palomarin and Wittenberg soils but are less than 40 inches deep to bedrock, and soils that have a clay loam subsoil. Also included are small areas of Rock outcrop on ridgetops and soils that are similar to this Palomarin soil but have a gravelly loam surface layer. Included areas make up about 30 percent of the total acreage.

The Palomarin soil is deep and well drained. It formed in material derived from siliceous shale or sandstone. Typically, the surface is covered with a mat of Douglas-fir needles about 2 inches thick. The surface layer is dark grayish brown and brown loam about 18 inches thick. The underlying material is brown loam 23 inches thick. Siliceous shale is at a depth of 41 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Palomarin soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Wittenberg soil is deep and well drained. It formed in material derived from siliceous shale. Typically, the surface is covered with a mat of Douglas-fir needles about 4 inches thick. The surface layer is dark grayish brown very gravelly loam about 26 inches thick. The upper 11 inches of the underlying material is yellowish brown very gravelly loam, and the lower 13 inches is brown very gravelly loam. Siliceous shale is at a depth of 50 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Wittenberg soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This unit is suited to the production of Douglas-fir. On the basis of a site index of 165, it can produce about 13,275 cubic feet, or 66,050 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition. Minimizing the risk of erosion is essential in harvesting timber. Proper design of a road drainage system and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Steepness of slope restricts the kinds of equipment that can be used in forest management. Highlead or other cable logging methods can be used for harvesting timber; however, use of these methods is limited during November through April.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from these plants can prevent or prolong natural or artificial reestablishment of trees. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting is Douglas-fir.

This map unit is in capability subclass VIIe (4), nonirrigated.

157—Pits, quarries. Pits, quarries, consists of sand and gravel pits, refuse dumps, and rock quarries. The sand and gravel pits generally are associated with coarse alluvial soils, and the rock quarries typically are associated with igneous or hard sedimentary rock. These areas typically are barren. The characteristics of this unit are highly variable.

This unit is not suited to most uses.

This map unit is in capability subclass VIIIe.

158—Reyes clay. This very deep, somewhat poorly drained soil is on reclaimed tidelands. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are smooth. They are irregular in shape and are 50 to 500 acres in size. The native vegetation is

mainly water-tolerant plants. Elevation is 2 feet below sea level to 10 feet above. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 60 to 62 degrees F, and the average frost-free period is 280 to 300 days.

Typically, the surface layer is light brownish gray clay about 14 inches thick. The upper 27 inches of the underlying material is gray clay and silty clay, and the lower part to a depth of 60 inches or more is gray silty clay and silty clay loam. In some areas the surface layer is clay loam.

Included in this unit are small areas of Ballard, Blucher, and Cole soils and soils that are similar to the Reyes soil but are very poorly drained. Also included are small areas of saline soils.

Permeability of this Reyes soil is slow. Effective rooting depth is limited by a seasonal high water table that is at a depth of 3 to 5 feet from January to December. Runoff is very slow, and the hazard of water erosion is none to slight. This soil is subject to rare periods of flooding in winter.

Most areas of this unit are used for oat hay. A few areas are used for urban development.

This unit is suited to hay and pasture. The main limitations are the seasonal high water table and the acidity of the soil. The average annual yield per acre of oat hay is 1.5 tons. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for urban development, the main limitations are the seasonal high water table, the potential for shrinking and swelling, and subsidence. Drainage is needed if roads and building foundations are constructed. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be located above the expected flood level. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies.

This map unit is in capability unit IVw-9 (14), nonirrigated.

159—Rock outcrop-Xerorthents complex, 50 to 75 percent slopes. This map unit consists of long, narrow, rocky areas that rise abruptly along the coast and along inland terraces and plateaus. These areas separate the terraces and mountainous uplands from lower lying areas. They are composed of sandstone, slate, serpentinite, and chert. The vegetation is sparse, but it includes scattered shrubs, grass, and lichens.

Rock outcrop is exposed areas mainly of sandstone, slate, serpentinite, and chert.

Xerorthents consist of soil material derived from sandstone, slate, serpentinite, and chert that has collected at the base and on the face of Rock outcrop and in depressional areas. The properties and characteristics of Xerorthents are highly variable.

This unit is used mainly as watershed and for wildlife habitat.

This unit is subject to sloughing; therefore, construction at or near the edge of areas of the unit should be avoided.

This map unit is in capability subclass VIIIs (15).

160—Rodeo clay loam, 2 to 15 percent slopes. This very deep, poorly drained soil is in narrow valleys and basins. It formed in alluvium derived from various kinds of rock. Slopes are smooth. Areas are elongated in shape and are 5 to 100 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 20 to 200 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown clay loam about 14 inches thick. The subsurface layer is pale brown clay loam about 6 inches thick. The upper 20 inches of the subsoil is pale brown, light yellowish brown, and brownish yellow clay, and the lower part to a depth of 60 inches or more is light gray, brownish yellow, and yellowish brown clay.

Included in this unit are small areas of Humaquepts, seeped, at the lower end of slopes; clayey soils that are in depressional areas and crack when dry; and very gravelly soils adjacent to drainageways. Also included are small areas of poorly drained, dark gray clay loam or sandy loam and areas of Rodeo soils that have slope of less than 2 percent.

Permeability of this Rodeo soil is slow. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. Water is perched above the subsoil at times from December to April.

This unit is used for recreation and livestock grazing.

This unit is suited to recreational development. It is limited mainly by the seasonal perched water table, slow permeability, and steepness of slope. Shaping and grading may be needed for camp and picnic areas. Cuts and fills should be seeded or mulched. Drainage should be provided to remove excess water.

This unit is suited to livestock grazing. The production of forage is limited by slow permeability and the seasonal perched water table. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are slow permeability and the seasonal perched water table. Plants that tolerate wetness should be seeded. Grazing

should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly California oatgrass, soft chess, and plantain.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

161—Saurin-Bonnydoon complex, 2 to 15 percent slopes. This map unit is on rolling uplands. Slopes are complex. Areas are irregular in shape and are 5 to 75 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 50 percent Saurin clay loam and 30 percent Bonnydoon gravelly loam. The Saurin soil is on convex side slopes, and the Bonnydoon soil is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils on north- and east-facing side slopes, soils that are on toe slopes and are similar to the Saurin soil but are more than 40 inches deep to bedrock, Los Osos soils on concave side slopes, and soils that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock or are very gravelly. Also included are small areas of soils that are similar to the Saurin soil but have a lighter colored surface layer. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and recreation.

The Bonnydoon soil is poorly suited to livestock grazing, but the Saurin soil is better suited to this use. The production of forage is limited by the very low available water capacity and the shallow depth of the Bonnydoon soil and the moderate available water capacity of the Saurin soil. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing.

The main limitations of this unit for seeding are the very low available water capacity and shallow depth of the Bonnydoon soil and the moderate available water capacity of the Saurin soil. Plants that tolerate drought should be seeded. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and broadleaf filaree.

This unit is suited to recreational development. The main limitation is steepness of slope. Shaping and grading may be needed in areas used for camps and playgrounds. Cuts and fills should be seeded or mulched.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

162—Saurin-Bonnydoon complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 5 to 100 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 40 percent Saurin clay loam and 30 percent Bonnydoon gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils on north-facing side slopes, Los Osos soils on concave side slopes, soils that are near Bolinas Ridge and are similar to the Saurin soil but have a darker colored surface layer that is 20 inches thick or more, and soils that are similar to the Bonnydoon soil but are less than 20 inches deep to bedrock or are very gravelly. Also included are small areas of soils that are similar to the Saurin soil but have a lighter colored surface layer.

Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

The Bonnydoon soil is poorly suited to livestock grazing, but the Saurin soil is better suited to this use. The production of forage is limited by steepness of slope, by the very low available water capacity and shallow soil depth of the Bonnydoon soil, and by the moderate available water capacity of the Saurin soil. The main limitations for seeding are the restricted available water capacity and steepness of slope. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and broadleaf filaree.

If this unit is used for recreational development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow depth. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Cuts and fills should be seeded or mulched.

This map unit is in capability unit IVe-1 (15), nonirrigated.

163—Saurin-Bonnydoon complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 50 to 250 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 50 percent Saurin clay loam and 40 percent Bonnydoon gravelly loam. The Saurin soil is on convex side slopes, and the Bonnydoon soil is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils on north- and east-facing side slopes, soils that are similar to the Saurin soil but are gravelly, soils that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock and are near ridgetops, and Los Osos soils on concave side slopes. Also included are small areas of soils that are similar to the Saurin soil but have a lighter colored surface layer and soils that are near Bolinas Ridge and have a darker colored surface layer more than 20 inches thick. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown gravelly loam about 11 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

The Bonnydoon soil is poorly suited to livestock grazing, but the Saurin soil is better suited to this use. The production of forage is limited by steepness of slope, by the very low available water capacity and the shallow depth of the Bonnydoon soil, and by the moderate available water capacity of the Saurin soil. Th

suitability of this unit for rangeland seeding is poor. The main limitations are steepness of slope and the restricted available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and broadleaf filaree.

If this unit is used for recreational development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow depth to rock. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Cuts and fills should be seeded or mulched.

This map unit is in capability subclass VIe (15), nonirrigated.

164—Saurin-Bonnydoon complex, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 350 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered shrubs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 50 percent Saurin clay loam and 40 percent Bonnydoon gravelly loam. The Saurin soil is on convex side slopes, and the Bonnydoon soil is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils on north- and east-facing side slopes, soils that are similar to the Saurin soil but are gravelly, soils that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock and are near ridgetops, and Los Osos soils on concave side slopes. Also included are small areas of soils that are similar to the Saurin soil but have a lighter colored surface layer and soils that are near Bolinas Ridge and have a darker colored surface layer that is more than 20 inches thick. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from shale or sandstone. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown and grayish brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and recreation.

The Bonnydoon soil is poorly suited to livestock grazing, but the Saurin soil is better suited to this use. The production of forage is limited by steepness of slope, by the very low available water capacity and the shallow depth of the Bonnydoon soil, and by the moderate available water capacity of the Saurin soil. The main limitations for seeding are the restricted available water capacity and steepness of slope. The Bonnydoon soil is also limited by shallow depth. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Mechanical treatment practices are not feasible because of the steepness of slope. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and filaree.

If this unit is used for recreational development, the main limitations are steepness of slope and, in the Bonnydoon soil, shallow depth to rock. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope.

This map unit is in capability subclass VIIe (15), nonirrigated.

165—Saurin-Urban land-Bonnydoon complex, 15 to 30 percent slopes. This map unit is on rolling uplands. Slopes are complex. Areas are irregular in shape and are 50 to 100 acres in size. The vegetation in areas not cultivated is mainly annual grasses, forbs, and scattered brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 30 percent Saurin clay loam, 25 percent Urban land, and 20 percent Bonnydoon gravelly loam. The Saurin soil is on convex side slopes, and the Bonnydoon soil is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils under a canopy of hardwoods, Xerorthents, soils that are similar to the Saurin soil but are gravelly, Saurin and Bonnydoon soils that have slope of less than 15 percent, and soils that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock. Also included are small areas of Los Osos soils and soils that have slipped. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is rapid, and the hazard of water erosion is slight.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for homesite development.

If this unit is used for homesite development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow depth. Cuts needed to provide essentially level building sites can expose bedrock. Extensive cutting and filling are generally required, and cut slopes are susceptible to excessive erosion. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being developed for urban use. Preserving the existing plant cover during construction helps to control erosion. Seeding, mulching, and shaping of slopes can be used to establish and maintain plant cover. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Intensive and extensive runoff control measures are also needed.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Increasing the size of the absorption field helps to compensate for the shallow depth of the Bonnydoon soil.

This map unit is in capability unit IVe-1 (15), nonirrigated.

166—Saurin-Urban land-Bonnydoon complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 75 acres in size. The native vegetation is mainly annual grass, forbs, and scattered brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 320 days.

This unit is 30 percent Saurin clay loam, 25 percent Urban land, and 20 percent Bonnydoon gravelly loam. The Saurin soil is on convex side slopes, and the Bonnydoon soil is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Tocaloma soils under a canopy of hardwoods, Xerorthents, soils that are similar to the Saurin soil but are gravelly, soils that are similar to the Bonnydoon soil but are less than 10 inches deep to bedrock and are on ridgetops, and Rock outcrop. Also included are small areas of Los Osos soils and soils that have slipped. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Sandstone is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20

to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is rapid, and the hazard of water erosion is slight.

The Bonnydoon soil is shallow and somewhat excessively drained. It formed in material derived from sandstone or shale. Typically, the soil is brown gravelly loam about 15 inches deep over sandstone. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Bonnydoon soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for homesite development.

If this unit is used for homesite development, the main limitation is steepness of slope. The Bonnydoon soil is also limited by shallow depth. Cuts needed to provide essentially level building sites can expose bedrock. Extensive cutting and filling are generally required, and cut slopes are susceptible to erosion. The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being developed for urban use. Preserving the existing plant cover during construction helps to control erosion. Intensive and extensive runoff control measures are also needed. Proper fertilizing, seeding, and shaping slopes can be used to establish and maintain plant cover. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Increasing the size of the absorption field helps to compensate for the shallow depth of the Bonnydoon soil.

This map unit is in capability subclass VIe (15), nonirrigated.

167—Sheridan Variant coarse sandy loam, 9 to 30 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 10 to 400 acres in size. The native vegetation is mainly conifers, brush, and annual grasses. Elevation is 20 to 1,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown coarse sandy loam about 26 inches thick. The underlying material is strong brown coarse sandy loam about 7 inches thick. Quartz-diorite is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Inverness soils on concave side slopes, Kehoe and Kehoe Variant soils under annual grasses, Rock outcrop that is mainly on ridgetops, and Sheridan Variant soils that have slope of less than 9 percent. Also included are small areas of Sirdrak soils, soils that are similar to the Sheridan Variant soil but are less than 20 inches deep to bedrock, and soils that have a reddish brown, clayey subsoil and are under grass.

Permeability of this Sheridan Variant soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used for recreation and homesite development and as woodland and rangeland.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are steepness of slope, depth to rock, and seepage. Excavation increases the risk of erosion. Cuts needed to provide essentially level building sites can expose bedrock. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Installing long absorption lines helps to compensate for the moderate depth.

This unit is suited to use as woodland. The main concerns in producing and harvesting timber are plant competition and seedling mortality. Conventional methods of harvesting timber may be limited when the soil is wet. Reforestation should be carefully managed to reduce competition from undesirable understory plants. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are bishop pine and Monterey pine.

This unit is suited to livestock grazing. The production of forage is limited by competition from woody plants and the very low to low available water capacity. Woody plants are the most abundant species on the soil in this unit. If trees and shrubs are managed to create open areas, however, the soil can produce a good stand of desirable forage plants. Erosion can be controlled by retaining the woody plants in the drainageways and in the steeper areas of the unit. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. Distribution of grazing can be achieved by the proper placement of salt and watering facilities for livestock.

Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Deferred grazing is necessary for the reestablishment of trees. The characteristic plant community on this unit is mainly bishop pine, tanoak, huckleberry, wild iris, and California brome.

Bishop pine, huckleberry, and annual grasses provide food and cover for deer, quail, rodents, and birds. Proper timing and amount of use of these plants by livestock help to maintain plant vigor and preserve food and cover for wildlife.

This map unit is in capability unit IVe-1 (15), nonirrigated.

168—Sheridan Variant coarse sandy loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 10 to 400 acres in size. The native vegetation is mainly conifers, brush, and annual grasses. Elevation is 20 to 1,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown and dark brown coarse sandy loam about 26 inches thick. The underlying material is strong brown coarse sandy loam about 5 inches thick over quartz-diorite. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Inverness soils on concave side slopes, Kehoe and Kehoe Variant soils under annual grasses, Rock outcrop that is mainly on ridgetops, and Sheridan Variant soils that have slope of less than 30 percent. Also included are small areas of soils that are similar to the Sheridan Variant soil but are less than 20 inches to bedrock and soils that have a reddish brown, clayey subsoil and are under grass.

Permeability of this Sheridan Variant soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for recreation and homesite development and as woodland and rangeland.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Areas used for recreation can also be protected from soil blowing and dust by maintaining plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are steepness of slope, depth to rock, and seepage. Excavation increases the risk of erosion. Cuts needed to provide essentially level building sites can expose bedrock. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This unit is suited to use as woodland. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, plant competition, and seedling mortality. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting timber are difficult to use because of slope. Highlead or other cable logging methods can be used; however, use of these methods is limited during November through April.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are bishop pine and Monterey pine.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and the very low to low available water capacity. Slope limits access by livestock and results in overgrazing of the less sloping areas. Distribution of grazing can be achieved by the proper placement of salt and watering facilities for livestock. Mechanical treatment practices are not feasible because of the steepness of slope. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing.

Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. The characteristic plant community on this unit is mainly bishop pine, tanoak, huckleberry, wild iris, and California brome.

Bishop pine, huckleberry, and annual grasses provide food and cover for deer, quail, rodents, and birds. Proper timing and amount of use of these plants by livestock help to maintain plant vigor and preserve food and cover for wildlife.

This map unit is in capability subclass VIe (15), nonirrigated.

169—Sheridan Variant coarse sandy loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material derived from quartz-diorite. Slopes are complex. Areas are irregular in shape and are 100 to 1,100 acres in size. The native vegetation is mainly conifers, brush, and annual grasses. Elevation is 20 to 1,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown coarse sandy loam about 26 inches thick. The substratum is strong brown coarse sandy loam about 7 inches thick over quartz-diorite. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Inverness soils on concave side slopes, Rock outcrop on ridgetops, soils that are similar to the Sheridan Variant soil but are less than 20 inches deep to bedrock and are near the top of slopes, and Sheridan Variant soils that have a gravelly loam surface layer. Also included are small areas of Kehoe and Kehoe Variant soils under annual grasses.

Permeability of this Sheridan Variant soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and homesite development and as woodland and rangeland.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope limits the use of areas of this unit mainly to a few paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are steepness of slope, depth to rock, and seepage. Cuts needed to provide essentially level building sites can expose bedrock. Excavation increases the risk of erosion. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This unit is suited to use as woodland. The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, plant competition, and seedling mortality. Minimizing the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting timber are difficult to use because of slope. Highlead or other cable logging methods can be used; however, use of these methods is limited during November through April.

Reforestation should be carefully managed to reduce competition from undesirable understory plants. Hand planting of nursery stock is usually necessary to establish or improve a stand. Among the trees that are suitable for planting are bishop pine and Monterey pine.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and the very low to low available water capacity. The soil in this unit supports sparse stands of plants that are suitable for grazing; woody plants are the most abundant species on this soil. The herbaceous plant cover readily deteriorates if it is overgrazed. Mechanical treatment practices are not feasible because of the steepness of slope. The soil should be protected from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. Proper placement of livestock watering facilities and salt promotes good distribution of grazing.

Bishop pine, huckleberry, and annual grasses provide food and cover for deer, quail, rodents, and birds. Proper timing and amount of use of these plants by livestock help to maintain plant vigor and preserve food and cover for wildlife. The characteristic plant community on this unit is mainly bishop pine, tanoak, huckleberry, wild iris, and California brome.

This map unit is in capability subclass VIIe (15), nonirrigated.

170—Sirdrak sand, 2 to 15 percent slopes. This very deep, somewhat excessively drained soil is in rolling, dunelike areas. It formed in eolian sand. Slopes are complex. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly brush and annual grasses. Elevation is 20 to 500 feet. The

average annual precipitation is 25 to 35 inches, the average annual air temperature is 53 to 56 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is very dark grayish brown sand about 36 inches thick. The next layer is dark yellowish brown sand 12 inches thick. Below this to a depth of 73 inches or more is yellowish brown and light yellowish brown sand.

Included in this unit are small areas of Dune land that is nearly barren of vegetation, Kehoe and Kehoe Variant soils at the lower end of slopes, Sheridan Variant soils on north- and east-facing side slopes, and Pablo and Bayview soils on rounded knolls. Also included are small areas of soils that are similar to the Sirdrak soil but are underlain by sandstone at a depth of less than 40 inches and small areas of poorly drained, clayey soils in narrow drainageways.

Permeability of this Sirdrak soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly for recreation and livestock grazing.

This unit is poorly suited to recreational development. The main limitations are the hazard of soil blowing and steepness of slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Areas used for recreation can also be protected from soil blowing and dustiness by maintaining plant cover. Paths and trails should extend across the slope.

This unit is poorly suited to livestock grazing. The production of forage is limited by low to moderate available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. Rangeland seeding is a suitable practice. Plants that are tolerant of droughtiness should be planted.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly bush lupine, perennial ryegrass, Mediterranean barley, and ripgut brome.

This map unit is in capability unit IVe-1 (15), nonirrigated.

171—Sirdrak sand, 15 to 50 percent slopes. This very deep, somewhat excessively drained soil is in rolling, dunelike areas. It formed in eolian sand. Slopes are complex and short. Areas are irregular in shape and are 25 to 200 acres in size. The native vegetation is mainly brush and annual grasses. Elevation is 20 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 53 to 56 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the upper 16 inches of the surface layer is dark grayish brown sand and the lower 20 inches is very dark grayish brown sand. Below this to a depth of 73 inches or more is light yellowish brown and dark yellowish brown sand.

Included in this unit are small areas of Dune land that is nearly barren of vegetation, Kehoe and Kehoe Variant soils at the lower end of slopes, Humaquepts in narrow drainageways, Sirdrak soils that have slope of less than 15 percent, and Pablo and Bayview soils on rounded knolls. Also included are small areas of soils that are similar to this Sirdrak soil but are underlain by sandstone or quartz-diorite at a depth of less than 40 inches and small areas of Sirdrak Variant soils.

Permeability of this Sirdrak soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly for recreation and livestock grazing.

This unit is poorly suited to recreational development. The main limitations are the hazard of soil blowing and steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Areas used for recreation can also be protected from soil blowing and dustiness by maintaining plant cover.

This unit is poorly suited to livestock grazing. The production of forage is limited by low to moderate available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly bush lupine, perennial ryegrass, Mediterranean barley, and ripgut brome.

This map unit is in capability subclass VIIe (15), nonirrigated.

172—Sirdrak Variant sand, 0 to 5 percent slopes. This deep, somewhat poorly drained soil is in dunelike areas. It formed in eolian sand. Slopes are complex.

Areas are irregular in shape and are 25 to 1,000 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 20 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is dark grayish brown, very dark grayish brown, and brown sand about 38 inches thick. A light yellowish brown, weakly cemented, discontinuous hardpan is between depths of 38 and 59 inches. The underlying material to a depth of 72 inches is light gray sand.

Included in this unit are small areas of Dune land and Sirdrak soils on the outer edges of mapped areas and Pablo and Bayview soils on rounded knolls. Also included are small areas of Tomales fine sandy loam on the outer edges of mapped areas.

Permeability of this Sirdrak Variant soil is rapid to a depth of 38 inches and very slow below this depth. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 2 to 3 feet from December to March.

This unit is used mainly for recreation and livestock grazing. Some areas are also used for hay.

This unit is suited to recreational development. The main limitations are the hazard of soil blowing and the seasonal high water table. Soil blowing and dustiness can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Shaping, grading, and drainage may be needed in areas used for camping and picnicking.

This unit is poorly suited to livestock grazing. The production of forage is limited by the low to moderate available water capacity and the seasonal high water table. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are low available water capacity, the hazard of soil blowing, and the seasonal high water table. Plants that tolerate wetness in winter and droughtiness in summer should be seeded. Grazing should be delayed until the more desirable plants have achieved sufficient growth to withstand grazing pressure. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material.

Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly coyotebush, bush lupine, and California brome.

This map unit is in capability unit IVe-1 (15), nonirrigated.

173—Sobega loam, 9 to 15 percent slopes. This moderately deep, well drained soil is on rolling uplands. It formed in material derived from coarse grained sandstone. Slopes are complex. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 100 to 800 feet. The average annual precipitation is 28 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is brown and pale brown loam about 17 inches thick. The subsoil is variegated yellow and very pale brown loam about 5 inches thick. Sandstone is at a depth of 22 inches. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Steinbeck and Tomales soils and Rock outcrop. Also included are small areas of soils that are similar to the Sobega soil but are less than 20 inches deep to bedrock and small areas of Sobega soils that have slope of less than 9 percent.

Permeability of this Sobega soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the low available water capacity. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. If the range vegetation is seriously deteriorated, seeding is needed. The main limitation for seeding is the low available water capacity. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Plants that tolerate drought should be seeded.

Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and broadleaf filaree.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

174—Sobega loam, 15 to 30 percent slopes. This moderately deep, well drained soil is on rounded uplands. It formed in material derived from coarse grained sandstone. Slopes are complex. Areas are irregular in shape and are 5 to 75 acres in size. The native vegetation is mainly annual grasses, forbs, and brush. Elevation is 100 to 800 feet. The average annual precipitation is 28 to 40 inches, the average annual air temperature is 55 to 59 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is brown and pale brown loam about 17 inches thick. The subsoil is variegated yellow and very pale brown loam about 5 inches thick. Sandstone is at a depth of 22 inches. Depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Steinbeck and Tomales soils. Also included are small areas of Rock outcrop, soils that are similar to the Sobega soil but are less than 20 inches deep to bedrock, and Sobega soils that have slope of more than 30 percent.

Permeability of this Sobega soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and the low available water capacity. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The suitability of the soil in this unit for rangeland seeding is poor. The main limitations for seeding are steepness of slope and the low available water capacity. Plants that tolerate drought and meet the seasonal requirements of livestock or wildlife or of both, should be selected for seeding.

Slope limits access by livestock and promotes overgrazing of the less sloping areas. Proper placement of livestock watering facilities and salt promotes good distribution of grazing. Mechanical treatment practices are not practical because of the steepness of slope. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly wild oat, soft chess, and broadleaf filaree.

This map unit is in capability unit IVe-1 (15), nonirrigated.

175—Tamalpais-Barnabe Variant very gravelly loams, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 20 to 100 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 40 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 60 percent Tamalpais very gravelly loam and 30 percent Barnabe Variant very gravelly loam. These soils are on side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Barnabe and Cronkhite soils on side slopes and ridgetops, soils that are similar to the Tamalpais soil but do not have a clayey subsoil, and soils that are similar to the Barnabe Variant soil but are more than 20 inches deep to bedrock. Also included are small areas of Rock outcrop on ridgetops, soils that are similar to the Barnabe Variant soil but are less than 10 inches deep to bedrock and are on ridgetops, and soils that are similar to the Tamalpais soil but are nongravelly throughout the profile. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Tamalpais soil is moderately deep and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark brown very gravelly loam about 19 inches thick. The upper 9 inches of the subsoil is brown very gravelly clay loam. and the lower 11 inches is dark reddish brown very gravelly clay loam. Bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tamalpais soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe Variant soil is shallow and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark reddish brown very gravelly loam about 5 inches thick. The subsoil is dark reddish brown very gravelly loam about 8 inches thick. Bedrock is at a depth of 13 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for recreation and livestock grazing. Some areas are also used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and gravel. The Barnabe Variant soil is also limited by shallow depth. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the

beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This unit is poorly suited to livestock grazing. The production of forage is limited mainly by competition from woody plants. The Barnabe Variant soil is also limited by shallow soil depth and the very low available water capacity. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The main limitations of the unit for seeding are competition from woody plants, steepness of slope, and gravel on the surface. The Barnabe Variant soil is also limited by low available water capacity and shallow depth. Plants that tolerate drought and meet the seasonal requirements of livestock or wildlife, or both, should be selected for seeding.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Brush management generally is not economically feasible. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly coyotebrush, California sagebrush, needlegrass, perennial ryegrass, and plantain.

If this unit is used for homesite development, the main limitations are steepness of slope, the shallow depth of the Barnabe Variant soil, and the content of gravel. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed.

Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes. Removal of gravel in disturbed areas is needed for best results in landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Installing long absorption lines helps to compensate for the restricted depth.

This map unit is in capability unit IVe-1 (15), nonirrigated.

176—Tamalpais-Barnabe Variant very gravelly loams, 30 to 50 percent slopes. This map unit is on mountainous uplands. Slopes are complex. Areas are irregular in shape and are 10 to 1,100 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 40 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Tamalpais very gravelly loam and 30 percent Barnabe Variant very gravelly loam. These soils are on side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Barnabe soils on convex side slopes and ridgetops, Cronkhite soils on convex side slopes, Rock outcrop on ridgetops, soils that are similar to the Barnabe Variant soil but are less than 10 inches deep to bedrock and are near ridgetops, soils that are similar to the Tamalpais soil but are not so clayey in the subsoil, and soils that are similar to the Barnabe Variant soil but are more than 20 inches deep to bedrock. Also included are small areas of soils that are similar to the Tamalpais soil but are nongravelly throughout the surface layer and subsoil. Included areas make up about 20 percent of the total acreage.

The Tamalpais soil is moderately deep and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark brown very gravelly loam about 19 inches thick. The upper 9 inches of the subsoil is brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very gravelly clay loam. Bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tamalpais soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe Variant soil is shallow and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark reddish brown very gravelly loam about 5 inches thick. The subsoil is dark reddish brown very gravelly loam about 8 inches thick. Bedrock is at a depth of 13 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for recreation and livestock grazing. Some areas are also used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and the content of gravel and by the shallow depth of the Barnabe Variant soil. Slope restricts the use of areas of this unit

mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This unit is poorly suited to livestock grazing. The production of forage is limited mainly by competition from woody plants. The unit is also limited by shallow depth and the very low available water capacity of the Barnabe Variant soil. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The suitability of this unit for rangeland seeding is poor. The main limitations are competition from woody plants, excessive gravel, and steepness of slope. The unit is also limited by shallow depth and the very low available water capacity of the Barnabe Variant soil.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on the unit is mainly coyotebrush, California sagebrush, needlegrass, perennial ryegrass, and plantain.

If this unit is used for homesite development, the main limitations are steepness of slope, the shallow depth of the Barnabe Variant soil, and the content of gravel in the soils. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed.

Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes. Removal of gravel in disturbed areas is needed for best results in landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour.

This map unit is in capability subclass VIs (15), nonirrigated.

177—Tamalpais-Barnabe Variant very gravelly loams, 50 to 75 percent slopes. This map unit is on mountainous uplands. Slopes are complex. Areas are irregular in shape and are 5 to 1,200 acres in size. The native vegetation is mainly brush, annual grasses, and forbs. Elevation is 40 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 50 to 56 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Tamalpais very gravelly loam and 40 percent Barnabe Variant very gravelly loam. These soils are on side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Barnabe and Cronkhite soils on side slopes, Rock outcrop, soils that are similar to the Tamalpais soil but are not so clayey in the subsoil, and soils that are similar to the Barnabe Variant soil but are more than 20 inches deep to bedrock and are on side slopes. Also included are small areas of soils that are similar to the Tamalpais soil but are nongravelly throughout the profile. Included areas make up about 10 percent of the total acreage.

The Tamalpais soil is moderately deep and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark brown very gravelly loam about 19 inches thick. The upper 9 inches of the subsoil is brown very gravelly clay loam, and the lower 11 inches is dark reddish brown very gravelly clay loam. Bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tamalpais soil is moderately slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Barnabe Variant soil is shallow and well drained. It formed in material derived from chert or sandstone. Typically, the surface layer is dark reddish brown very gravelly loam about 5 inches thick. The subsoil is dark reddish brown very gravelly loam about 8 inches thick. Bedrock is at a depth of 13 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the Barnabe Variant soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for recreation and livestock grazing. Some areas are also used for homesite development.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and the content of gravel in the soils and by the shallow depth of the Barnabe Variant soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by controlling traffic.

This unit is poorly suited to livestock grazing. The production of forage is limited mainly by competition from woody plants. The unit is also limited by shallow depth and the very low available water capacity of the Barnabe Variant soil. This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The suitability of the unit for rangeland seeding is poor. The main limitations for seeding are competition from woody plants and steepness of slope.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly coyotebrush, California sagebrush, needlegrass, and perennial ryegrass.

If this unit is used for homesite development, the main limitations are steepness of slope, the shallow depth of the Barnabe Variant soil, and the content of gravel. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed.

Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes. Removal of gravel in disturbed areas is needed for best results in landscaping, particularly in areas used for lawns. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Installing long absorption lines helps to compensate for the restricted depth.

This map unit is in capability subclass VIIs (15), nonirrigated.

178—Tocaloma-McMullin complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 15 to 90 acres in size. The native vegetation is mainly mixed hardwoods and brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 40 percent Tocaloma loam and 35 percent McMullin gravelly loam. The Tocaloma soil is on convex side slopes, and the McMullin soil is near the upper end of convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Saurin soils on plane side slopes; soils that are similar to the Tocaloma soils but have a darker colored surface layer that is more than 20 inches thick, are more than 40 inches deep to bedrock, or are very gravelly; and soils that are similar to the McMullin soil but are more than 10 inches deep to bedrock, are less than 35 percent gravel, or have a clay loam subsoil. Also included are small areas of Rock outcrop and Los Osos soils. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in material derived from sandstone. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 14 inches thick. Fractured sandstone is at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the McMullin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for the production of firewood.

This unit is suited to the production of firewood. The main concerns in producing and harvesting firewood are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations for access roads is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting firewood can be used. Natural reforestation can be accomplished by permitting stump sprouts to grow.

This map unit is in capability unit IVe-1 (15), nonirrigated.

179—Tocaloma-McMullin complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 2,000 acres in size. The native vegetation is mainly mixed hardwoods and brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 40 percent Tocaloma loam and 35 percent McMullin gravelly loam. The Tocaloma soil is on convex side slopes, and the McMullin soil is near the upper part of convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Saurin soils on plane side slopes; soils that are similar to the Tocaloma soil but have a darker colored surface layer that is more than 20 inches thick, are more than 40 inches deep to bedrock, have a clay loam subsoil, or are very gravelly; and soils that are similar to the McMullin soil but are less than 10 inches deep to bedrock, are very gravelly, or have a clay loam subsoil. Also included are small areas of Los Osos soils, Rock outcrop, and soils that are similar to the Tocaloma soil but have a lighter colored surface layer. Included areas make up about 25 percent of the total acreage.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 14 inches thick. Fractured bedrock is at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the McMullin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for the production of firewood.

This unit is suited to the production of firewood. The main concerns in producing and harvesting firewood are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations for access roads is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting firewood can be used in the less sloping areas, but their use is limited in the steeper areas. Natural reforestation can be accomplished by permitting stump sprouts to grow.

This map unit is in capability subclass VIe (15), nonirrigated.

180—Tocaloma-McMullin complex, 50 to 75 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 25 to 2,000 acres in size. The native vegetation is mainly mixed hardwoods and brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 40 percent Tocaloma loam and 35 percent McMullin gravelly loam. The Tocaloma soil is on convex side slopes, and the McMullin soil is near the upper part of convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Saurin and Bonnydoon soils on convex side slopes; soils that are similar to the Tocaloma soil but are more than 40 inches deep to bedrock, are on concave side slopes, are very gravelly, or are less than 20 inches deep to bedrock; soils that are similar to the McMullin soil but are less than 10 inches deep to bedrock; Rock outcrop on ridgetops; and Maymen soils on the upper part of side slopes near Mount Tamalpais. Also included are small areas of soils that are near Novato and are similar to the Tocaloma soil but have a lighter colored surface layer. Included areas make up about 25 percent of the total acreage.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The McMullin soil is shallow and well drained. It formed in material derived from sandstone. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 14 inches thick. Fractured sandstone is at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the McMullin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used mainly for the production of firewood.

The main concerns in producing and harvesting firewood on this unit are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations for access roads is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting firewood are difficult to use because of slope. Natural reforestation can be accomplished by permitting stump sprouts to grow.

This map unit is in capability subclass VIIe (15), nonirrigated.

181—Tocaloma-McMullin-Urban land complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 30 to 150 acres in size. The native vegetation is mainly mixed hardwoods and brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 30 percent Tocaloma loam, 25 percent McMullin gravelly loam, and 25 percent Urban land. The Tocaloma soil is on convex side slopes, and the McMullin soil is near the upper part of convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Xerorthents, Saurin soils on convex side slopes, Dipsea soils in drainageways and on north-facing side slopes, soils that are similar to the Tocaloma soil but are less than 20 inches deep to bedrock, and soils that are similar to the McMullin soil but are less than 10 inches deep to bedrock. Also included are small areas of Tocaloma and McMullin soils that have slope of less than 15 percent or more than 30 percent. Included areas make up about 20 percent of the total acreage.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in material derived from sandstone. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 14 inches thick. Fractured sandstone is at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the McMullin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is very rapid.

This unit is used for homesite development.

The main limitation of this unit for homesite development is steepness of slope. The McMullin soil is also limited by shallow depth. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Excavation increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible helps to control erosion. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Removal of pebbles and cobbles is needed for best results in landscaping, particularly for lawns. Structures to divert runoff are needed if buildings and roads are constructed.

Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Installing long absorption lines helps to compensate for the restricted depth.

This map unit is in capability unit IVe-1 (15), nonirrigated.

182—Tocaloma-McMullin-Urban land complex, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 20 to 700 acres in size. The native vegetation is mainly mixed hardwoods and brush. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 55 to 60 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 40 percent Tocaloma loam, 20 percent McMullin gravelly loam, and 20 percent Urban land. The Tocaloma and McMullin soils are on mountainous hilltops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Xerorthents, Saurin soils on convex side slopes, Dipsea soils in drainageways and on north-facing side slopes, soils that

are similar to the Tocaloma soil but are less than 20 inches deep to bedrock, and soils that are similar to the McMullin soil but are less than 10 inches deep to bedrock. Also included are small areas of Tocaloma and McMullin soils that have slope of less than 30 percent or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in material derived from sandstone. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is light yellowish brown gravelly loam about 14 inches thick. Fractured sandstone is at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of the McMullin soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is very rapid.

This unit is used for homesite development.

The main limitation of this unit for homesite development is steepness of slope. The McMullin soil is also limited by shallow depth. Cuts needed to provide essentially level building sites can expose bedrock. Extensive cutting and filling generally are required, and cut slopes are susceptible to erosion. Control of runoff is needed.

The hazards of soil erosion and siltation are high, particularly in the steeper areas. They are highest while the soil is being developed for urban use. Preserving the existing plant cover during construction and revegetating disturbed areas around construction sites as soon as possible help to control erosion. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Removal of pebbles and cobbles is needed for best results in landscaping, particularly for lawns.

Effluent from septic tank absorption fields can surface downslope and thus create a hazard to health. If the density of housing is moderate to high, a community sewage system is needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems. Slope is a concern in installing septic tank absorption fields; therefore, absorption lines should be installed on the contour. Installing long absorption lines helps to compensate for the restricted depth.

This map unit is in capability subclass VIe (15), nonirrigated.

183—Tocaloma-Saurin association, steep. This map unit is on uplands. Slope is 15 to 30 percent. Areas are irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly hardwoods on the Tocaloma soil and annual grasses and forbs on the Saurin soil. Elevation is 50 to 1,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 290 to 330 days.

This unit is 35 percent Tocaloma loam and 30 percent Saurin clay loam. The Tocaloma soil is on north- and east-facing side slopes and in drainageways, and the Saurin soil is on hilltops and side slopes.

Included in this unit are small areas of Bonnydoon soils on ridgetops, McMullin soils near the top of slopes, Los Osos soils on concave side slopes, and soils that are similar to these Tocaloma and Saurin soils but are gravelly throughout the profile. Included areas make up about 35 percent of the total acreage. The percentage varies from one area to another.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Bedrock is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly as rangeland and for wildlife habitat. Some areas are used for firewood production.

The characteristic plant community is mainly wild oat and soft chess on the Saurin soil, and it is mainly California-laurel and live oak on the Tocaloma soil.

The Saurin soil is suited to livestock grazing. The production of forage is limited by the moderate available water capacity. Rangeland seeding is suitable if the range is in poor condition. The main limitations for seeding are steepness of slope and the moderate available water capacity.

Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Management practices suited to this soil are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing.

The Tocaloma soil is suited to the production of firewood. The main concerns in producing and harvesting firewood are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations for access roads is subject to rill and gully erosion and to sloughing. Conventional methods of harvesting firewood can be used. Natural reforestation can be accomplished by permitting stump sprouts to grow.

This map unit is in capability unit IVe-1 (15), nonirrigated.

184—Tocaloma-Saurin association, very steep. This map unit is on uplands. Slope is 30 to 50 percent. Areas are irregular in shape and are 25 to 1,500 acres in size. The native vegetation is mainly hardwoods on the Tocaloma soil and annual grasses and forbs on the Saurin soil. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 330 days.

This unit is 40 percent Tocaloma loam and 30 percent Saurin clay loam. The Tocaloma soil is on north- and east-facing side slopes, and the Saurin soil is on hilltops and side slopes.

Included in this unit are small areas of Bonnydoon and McMullin soils on ridgetops, Los Osos soils on concave side slopes, Montara soils on ridgetops, soils that are similar to these Tocaloma and Saurin soils but are gravelly throughout the profile, and soils that are similar to the Saurin soil but have a lighter colored surface layer. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Bedrock is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for the production of firewood and for livestock grazing.

The characteristic plant community is mainly California-laurel and live oak on the Tocaloma soil, and it is mainly wild oat and soft chess on the Saurin soil.

The Tocaloma soil is suited to the production of firewood. The main concerns in producing and harvesting firewood are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Natural reforestation can be accomplished by permitting stump sprouts to grow.

The Saurin soil is suited to livestock grazing. The production of forage is limited by steepness of slope, the moderate available water capacity, and competition from woody plants. If the range vegetation is seriously deteriorated, seeding is needed. The main limitations for seeding are steepness of slope and the moderate available water capacity.

Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Slope restricts access by livestock and results in overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Management practices suited to this soil are proper grazing use, deferred grazing, rotation grazing, and aerial spraying for brush management. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing.

This map unit is in capability subclass VIe (15), nonirrigated.

185—Tocaloma-Saurin association, extremely steep. This map unit is on uplands. Slope is 50 to 75 percent. Areas are irregular in shape and are 50 to 600 acres in size. The native vegetation is mainly hardwoods on the Tocaloma soil and annual grasses and forbs on the Saurin soil. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 58 to 62 degrees F, and the average frost-free period is 270 to 330 days.

This unit is 40 percent Tocaloma loam and 30 percent Saurin clay loam. The Tocaloma soil is on north- and east-facing side slopes and in drainageways, and the Saurin soil is on ridgetops and side slopes.

Included in this unit are small areas of Bonnydoon and McMullin soils on ridgetops and near the top of slopes, soils that are similar to the Saurin soil but are less than 10 inches deep to bedrock, soils that are similar to these Tocaloma and Saurin soils but are gravelly throughout the profile, and Rock outcrop on ridgetops. Included areas make up about 30 percent of the total acreage. The percentage varies from one area to another.

The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown and brown loam about 19 inches thick. The subsoil is light yellowish brown very gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 39 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Tocaloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Saurin soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is yellowish brown clay loam about 22 inches thick. The subsoil is yellowish brown clay loam about 11 inches thick. Bedrock is at a depth of 33 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Saurin soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for the production of firewood and for livestock grazing.

The characteristic plant community is mainly California-laurel and live oak on the Tocaloma soil, and it is mainly wild oat and soft chess on the Saurin soil.

The Tocaloma soil is suited to the production of firewood. The main concerns in producing and harvesting firewood are the hazard of erosion and equipment limitations. Minimizing the risk of erosion is essential in harvesting firewood. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Natural reforestation can be accomplished by permitting stump sprouts to grow.

The Saurin soil is suited to livestock grazing. The production of forage is limited by steepness of slope and the moderate available water capacity.

Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Slope restricts access by livestock and results in overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Management practices suited to this soil are proper range use, deferred grazing, rotation grazing, and brush management. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing.

This map unit is in capability subclass VIIe (15), nonirrigated.

186—Tomales fine sandy loam, 2 to 9 percent slopes. This deep, moderately well drained soil is on uplands. It formed in material derived from sandstone. Slopes are rounded. Areas are irregular in shape and are 20 to 300 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Soft sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sirdrak soils at the lower end of slopes, Steinbeck soils on convex side slopes, Sobega soils on ridgetops, and Humaquepts, seeped, in drainageways. Also included are small areas of Bayview and Pablo soils on rounded knolls.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development. It is limited mainly by the very slow permeability. Shaping and leveling may be needed in areas used for playgrounds and for camp and picnic areas. The unit has few limitations for paths and trails. Drainage should be provided to compensate for the very slow permeability. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the

area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is the very slow permeability. Plants that tolerate seasonal wetness should be seeded.

Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, Pacific reedgrass, and soft chess.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

187—Tomales fine sandy loam, 9 to 15 percent slopes. This deep, moderately well drained soil is on uplands. It formed in material derived from sandstone. Slopes are rounded. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Soft sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sirdrak soils at the lower end of slopes, Steinbeck soils on convex side slopes, Sobega soils on ridgetops, and Humaquepts, seeped, in drainageways. Also included are small areas of Bayview and Pablo soils on rounded knolls.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope and the very slow permeability. Slope limits the use of this unit mainly to a few paths and trails, which should extend across the slope. Drainage should be provided to compensate for the very slow permeability. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is the very slow permeability. Plants that tolerate seasonal wetness should be seeded.

Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, Pacific reedgrass, and soft excess.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

188—Tomales fine sandy loam, 15 to 30 percent slopes. This deep, moderately well drained soil is on uplands. It formed in material derived from sandstone. Slopes are rounded. Areas are irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly annual grasses, forbs, and scattered shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sobega soils on ridgetops, Steinbeck soils on convex side slopes, and soils that are similar to Tocaloma soils but have a mean soil temperature that varies less than 9 degrees F from summer to winter. Also included are small areas of Rock outcrop and Pablo and Bayview soils on ridgetops and rounded knolls.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of the unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by competition from woody plants. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are steepness of slope and competition from woody plants.

Management practices suited to this unit are proper grazing use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, Pacific reedgrass, and soft chess.

This map unit is in capability unit IVe-3 (15), nonirrigated.

189—Tomales fine sandy loam, 30 to 50 percent slopes. This deep, moderately well drained soil is on uplands. It formed in material derived from sandstone. Slopes are complex. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sobega soils on ridgetops; Steinbeck soils on convex side slopes; Humaquepts, seeped, in drainageways; and soils that are similar to Tocaloma soils but have a mean soil temperature that varies less than 9 degrees F from summer to winter. Also included are small areas of Rock outcrop and Bayview and Pablo soils on rounded knolls.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of the unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope and competition from woody plants. Slope limits access by livestock and results in overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, Pacific reedgrass, and soft chess.

This map unit is in capability subclass VIe (15), nonirrigated.

190—Tomales loam, 2 to 9 percent slopes. This deep, moderately well drained soil is on rolling coastal hills. It formed in material derived from sandstone. Slopes are smooth. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The upper 10 inches of the subsoil is variegated light brownish gray and pale brown clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sobega soils near the upper part of convex side slopes, Steinbeck soils on convex side slopes, Tocaloma soils that are on north- and east-facing side slopes and are under a canopy of hardwoods, and soils that are similar to the Tomales soil but are less than 40 inches deep to bedrock. Also included are small areas of Tomales soils that have slope of more than 9 percent, a few active gullies, small areas of Yorkville soils that have a mean annual soil temperature of less than 72 degrees F, and areas that have slipped.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing. Some areas are used for homesite development.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should tolerate seasonal wetness and meet the seasonal requirements of livestock or wildlife, or both. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, soft chess, and Pacific reedgrass.

If this unit is used for homesite development, the main limitations are the very slow permeability and the

potential for shrinking and swelling. Drainage should be provided to compensate for the very slow permeability. Structures to divert runoff are needed if buildings and roads are constructed. Buildings and roads should be designed to offset the effects of shrinking and swelling. These effects can be minimized by using proper engineering design and backfilling with material that has low shrink-swell potential. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and by using long absorption lines and backfilling the trench with sandy material.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

191—Tomales loam, 9 to 15 percent slopes. This deep, moderately well drained soil is on rolling coastal hills. It formed in material derived from sandstone. Slopes are smooth. Areas are irregular in shape and are 25 to 450 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown, grayish brown, and very pale brown loam about 12 inches thick. The upper 10 inches of the subsoil is variegated light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay loam. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sobega soils on the upper part of convex side slopes, Steinbeck soils on convex side slopes, Tocaloma soils that are under a stand of hardwoods, and soils that are similar to the Tomales soil but are less than 40 inches deep to bedrock. Also included are small areas of Tomales soils that have slope of less than 9 percent and Yorkville soils that have a mean annual soil temperature of less than 72 degrees F, a few active gullies, and areas that have slipped.

Permeability of this Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing. Some areas are used for homesite development.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The plants selected for seeding should tolerate seasonal wetness and meet the seasonal requirements of livestock or wildlife, or both. Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, soft chess, Pacific reedgrass, and redtop.

If this unit is used for homesite development, the main limitations are the very slow permeability and the potential for shrinking and swelling. Drainage should be provided to compensate for the very slow permeability. Structures to divert runoff are needed if buildings and roads are constructed. Buildings and roads should be designed to offset the effects of shrinking and swelling. These effects can be minimized by using proper engineering design and backfilling with material that has low shrink-swell potential. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and by using long absorption lines and backfilling the trench with sandy material.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

192—Tomales loam, 15 to 30 percent slopes. This deep, moderately well drained soil is on rolling uplands. It formed in material derived from sandstone. Slopes are smooth. Areas are irregular in shape and are 20 to 100 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The upper 10 inches of the subsoil is variegated light brownish gray and pale brown clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Barnabe soils on ridgetops, Sobega and Steinbeck soils on side slopes, and Tocaloma soils under a canopy of hardwoods. Also included are small areas of Tomales soils that have slope of less than 15 percent.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. Some areas are used for homesite development.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. The soil in this unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are steepness of slope and very slow permeability. Plants selected for seeding should tolerate seasonal wetness and meet the seasonal requirements of livestock or wildlife or of both.

Brush management improves deteriorated areas of rangeland that are producing more woody shrubs than were present in the characteristic plant community. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, soft chess, and Pacific reedgrass.

If this unit is used for homesite development, the main limitations are steepness of slope, very slow permeability, and the potential for shrinking and swelling. Drainage should be provided to compensate for the very slow permeability. Structures to divert runoff are needed if buildings and roads are constructed. Buildings and roads should be designed to offset the effects of shrinking and swelling. These effects can be minimized by using proper engineering design and backfilling with material that has low shrink-swell potential. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If this unit is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field and by using long absorption lines and backfilling the trench with sandy material. Absorption lines should be placed on the contour.

This map unit is in capability unit IVe-3 (15), nonirrigated.

193—Tomales loam, 30 to 50 percent slopes. This deep, moderately well drained soil is on rolling uplands. It formed in material derived from sandstone. Slopes are smooth. Areas are irregular in shape and are 5 to 125 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The upper 10 inches of the subsoil is variegated light brownish gray and pale brown clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of Sobega soils on convex side slopes of ridgetops, Steinbeck soils on convex side slopes, and Tocaloma soils on north- and east-facing side slopes and in drainageways. Also included are small areas of Tomales soils that have slope of more than 50 percent and soils that are similar to the Tomales soil but are less than 40 inches deep to bedrock, soils that have slipped, and Rock outcrop.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability. Slope limits access by livestock and promotes overgrazing of the less sloping areas. Mechanical treatment practices are not feasible because of the steepness of slope.

Areas where brush is managed by prescribed burning or by chemical or mechanical methods may be subject to a higher risk of erosion. Livestock grazing should be managed to protect the soil in this unit from erosion. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly blue wildrye, soft chess, and Pacific reedgrass.

This map unit is in capability subclass VIe (15), nonirrigated.

194—Tomales-Sobega loams, 15 to 30 percent slopes. This map unit is on rolling hills. Slopes are smooth. Areas are irregular in shape and are 5 to 170 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 59 degrees F, and the average frost-free period is 270 to 330 days.

This unit is 50 percent Tomales loam and 30 percent Sobega loam. The Tomales soil is on convex side slopes, and the Sobega soil is on the upper part of side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Barnabe soils on ridgetops, Steinbeck soils on convex side slopes, Tomales and Sobega soils that have slope of more than 30 percent, and Tocaloma soils that are under a canopy of hardwoods. Also included are small areas of Rock outcrop on ridgetops. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically,

the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The upper 10 inches of the subsoil is variegated light brownish gray and pale brown clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Sobega soil is moderately deep and well drained. It formed in material derived from coarse-grained sandstone. Typically, the surface layer is brown loam about 17 inches thick. The subsoil is variegated yellow and very pale brown loam about 5 inches thick. Sandstone is at a depth of 22 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Sobega soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability of the Tomales soil and the low available water capacity of the Sobega soil. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. If the range vegetation is seriously deteriorated, seeding is needed. Plants that meet the seasonal requirements of livestock or wildlife, or both, that tolerate the seasonal wetness of the Tomales soil, and that tolerate the droughtiness of the Sobega soil should be selected for seeding. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, blue wildrye, wild oat, and Pacific reedgrass.

This map unit is in capability unit IVe-3 (15), nonirrigated.

195—Tomales-Sobega complex, 9 to 15 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Tomales fine sandy loam and 30 percent Sobega sandy loam. The Tomales soil is on convex side slopes, and the Sobega soil is near the upper part of convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Humaquepts, seeped, in drainageways; Sirdrak soils near the lower part of side slopes; and Steinbeck soils on side slopes. Also included are small areas of Bayview and Pablo soils on rounded knolls. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale brown clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Sobega soil is moderately deep and well drained. It formed in material derived from coarse-grained sandstone. Typically, the surface layer is brown sandy loam about 17 inches thick. The subsoil is variegated yellow and very pale brown loam about 5 inches thick. Sandstone is at a depth of 22 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Sobega soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for recreation and livestock grazing.

This unit is suited to recreational development. It is limited mainly by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. If areas of the unit are used for playgrounds, shaping and grading may be needed. Drainage should be provided for paths, trails, and playgrounds. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by the low available water capacity of the Sobega soil and the very slow permeability of the Tomales soil. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitation for seeding is the low available water capacity of the Sobega soil. Plants that tolerate the seasonal wetness of the Tomales soil and the droughtiness of the Sobega soil should be selected for seeding.

Grazing should be delayed until the soils in this unit have drained sufficiently and until they are firm enough to withstand trampling by livetock. Erosion is reduced by maintaining an adequate plant cover and allowing

sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly blue wildrye and Pacific reedgrass on the Tomales soil, and it is mainly wild oat and soft chess on the Sobega soil.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

196—Tomales-Sobega complex, 15 to 30 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 10 to 120 acres in size. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Tomales fine sandy loam and 30 percent Sobega sandy loam. The Tomales soil is on convex side slopes, and the Sobega soil is near the top of slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Dune land near the lower end of slopes; Humaquepts, seeped, in drainageways; Steinbeck fine sandy loam on side slopes; and Tomales and Sobega soils that have slope of more than 30 percent. Also included are small areas of Tocaloma soils that are on north-facing side slopes and soils that are similar to the Tomales soil but are less than 40 inches deep to bedrock. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically, the surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Sobega soil is moderately deep and well drained. It formed in material derived from coarse-grained sandstone. Typically, the surface layer is brown sandy loam about 17 inches thick. The subsoil is variegated yellow and very pale brown loam about 5 inches thick. Sandstone is at a depth of 22 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Sobega soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development, however, as it is limited by steepness of slope. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of vegetation suitable for livestock grazing is limited by the low available water capacity of the Sobega soil. Slope restricts access by livestock and results in overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. This unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are the low available water capacity of the Sobega soil and the very slow permeability of the Tomales soil. Plants that tolerate the seasonal wetness of the Tomales soil and the droughtiness of the Sobega soil should be selected for seeding. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly blue wildrye and Pacific reedgrass on the Tomales soil, and it is mainly wild oat and soft chess on the Sobega soil.

This map unit is in capability unit IVe-3 (15), nonirrigated.

197—Tomales-Steinbeck fine sandy loams, 30 to 50 percent slopes. This map unit is on uplands. Slopes are complex. Areas are irregular in shape and are 5 to 50 acres in size. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 300 to 365 days.

This unit is 50 percent Tomales fine sandy loam and 30 percent Steinbeck fine sandy loam. The Tomales soil is on concave side slopes, and the Steinbeck soil is on convex side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sobega sandy loam near the top of slopes, Rodeo soils in drainageways, and soils that have slipped and are near the lower end of slopes. Also included are small areas of Bayview and Pablo soils on rounded knolls. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically,

The surface layer is brown fine sandy loam about 12 inches thick. The subsurface layer is pale brown and grayish brown loam about 12 inches thick. The upper 10 inches of the subsoil is light brownish gray and pale yellow clay, and the lower 13 inches is yellow clay. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Steinbeck soil is deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is dark grayish brown and grayish brown fine sandy loam about 23 inches thick. The subsurface layer is variegated very pale brown and pale brown loam about 12 inches thick. The subsoil is grayish brown and light yellowish brown clay loam about 13 inches thick. Sandstone is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Steinbeck soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for recreation and livestock grazing.

This unit is poorly suited to recreational development. The main limitations are steepness of slope and the very slow permeability of the Tomales soil. Slope restricts the use of areas of this unit mainly to paths and trails, which should extend across the slope. Drainage should be provided to compensate for the very slow permeability. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover. Plant cover can be maintained by limiting traffic.

This unit is suited to livestock grazing. The production of forage is limited by steepness of slope. Slope restricts access by livestock and results in overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Grazing should be delayed until the soils in this unit are firm enough to withstand grazing pressure. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly blue wildrye and Pacific reedgrass on the Tomales soil, and it is mainly soft chess and wild oat on the Steinbeck soil.

This map unit is in capability subclass VIe (15), nonirrigated.

198—Tomales-Steinbeck loams, 5 to 15 percent slopes. This map unit is on uplands. Slopes are smooth. Areas are irregular in shape and are 10 to 350 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

This unit is 50 percent Tomales loam and 30 percent Steinbeck loam. These soils are on ridgetops and side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sobega soils on ridgetops and side slopes, Tocaloma soils that are on north- and east-facing side slopes and are under a canopy of hardwoods, and Tomales and Steinbeck soils that have slope of less than 5 percent. Also included are small areas of Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The subsoil is light brownish gray and yellow clay about 23 inches thick. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Steinbeck soil is deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is dark grayish brown and grayish brown loam about 23 inches thick. The subsurface layer is variegated very pale brown and pale brown loam about 12 inches thick. The subsoil is grayish brown and light yellowish brown clay loam about 13 inches thick. Sandstone is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Steinbeck soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability of the Tomales soil. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. Plants that tolerate seasonal wetness should be seeded. Grazing should be delayed until the soils in the unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The

characteristic plant community is mainly soft chess, Pacific reedgrass, and burclover.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

199—Tomales-Steinbeck loams, 15 to 30 percent slopes. This map unit is on rolling uplands. Slopes are smooth. Areas are irregular in shape and are 5 to 800 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

This unit is 50 percent Tomales loam and 30 percent Steinbeck loam. These soils are on side slopes and ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sobega soils on ridgetops, Tocaloma soils that are on north- and east-facing side slopes and are under a canopy of hardwoods, soils that are similar to the Tomales and Steinbeck soils but are less than 40 inches deep to bedrock, and shallow, very gravelly soils on ridgetops. Also included are small areas of Rock outcrop on ridgetops, small areas of Tomales and Steinbeck soils that have slope of more than 30 percent, and a few gullied areas. Included areas make up about 20 percent of the total acreage.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The subsoil is light brownish gray and yellow clay about 23 inches thick. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Steinbeck soil is deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is dark grayish brown and grayish brown loam about 23 inches thick. The subsurface layer is variegated very pale brown and pale brown loam about 12 inches thick. The subsoil is grayish brown and light yellowish brown clay loam about 13 inches thick. Sandstone is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Steinbeck soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability of the Tomales soil. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. The unit responds well to fertilizer, to rangeland seeding, and to proper grazing use. The main limitations for seeding are steepness of slope and the very slow permeability of the Tomales soil. Plants that tolerate seasonal wetness and meet the seasonal requirements of livestock or wildlife, or both, should be selected for seeding. Grazing should be delayed until the soils in the unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly blue wildrye, soft chess, Pacific reedgrass, and burclover.

This map unit is in capability unit IVe-3 (15), nonirrigated.

200—Tomales-Steinbeck loams, 30 to 50 percent slopes. This map unit is on hilly uplands. Slopes are smooth. Areas are irregular in shape and are 5 to 50 acres in size. The native vegetation is mainly annual grasses, brush, and forbs. Elevation is 0 to 800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 52 to 57 degrees F, and the average frost-free period is 270 to 300 days.

This unit is 50 percent Tomales loam and 30 percent Steinbeck loam. These soils are on side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Sobega soils on ridgetops and side slopes; Tocaloma soils that are on north- and east-facing side slopes and are under a canopy of hardwood trees; soils that are similar to these Tomales and Steinbeck soils but are less than 40 inches deep to bedrock; shallow, very gravelly soils on ridgetops; and gullied soils. Also included are small areas of Rock outcrop on ridgetops, Tomales and Steinbeck soils that have slope of more than 50 percent, and Yorkville soils that have slipped. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Tomales soil is deep and moderately well drained. It formed in material derived from sandstone. Typically, the surface layer is brown loam about 12 inches thick. The subsurface layer is pale brown and very pale brown loam about 12 inches thick. The subsoil is light brownish gray and yellow clay about 23 inches thick. Sandstone is at a depth of 47 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Tomales soil is very slow. Available water capacity is moderate. Effective rooting depth is 40

to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Steinbeck soil is deep and well drained. It formed in material derived from sandstone. Typically, the surface layer is dark grayish brown and grayish brown loam about 23 inches thick. The subsurface layer is variegated very pale brown and pale brown loam about 12 inches thick. The subsoil is grayish brown and light yellowish brown clay loam about 13 inches thick. Sandstone is at a depth of 48 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Steinbeck soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

This unit is suited to livestock grazing. The production of forage is limited by the very slow permeability of the Tomales soil. The unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. The limitation of seepage can be overcome by sealing the water impoundments with impervious material. Slope limits access by livestock and promotes overgrazing of the less sloping areas. Proper placement of access roads, livestock trails, livestock watering facilities, and salt promotes good distribution of grazing. Mechanical treatment practices are not feasible because of the steepness of slope.

Grazing should be delayed until the soils in the unit are firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community is mainly burclover, soft chess, blue wildrye, and Pacific reedgrass.

This map unit is in capability subclass VIe (15), nonirrigated.

201—Urban land-Ballard complex, 0 to 9 percent slopes. This map unit is on alluvial fans and bench terraces. Slopes are long and smooth. Areas are irregular in shape and are 5 to 940 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 10 to 300 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 60 to 65 degrees F, and the average frost-free period is 250 to 280 days.

This unit is 55 percent Urban land and 25 percent Ballard gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of somewhat poorly drained Blucher and Cole soils on fans and in basins, Reyes soils on tidelands, and Hydraquents, saline, along the coast. Also included are small areas of soils that are similar to the Ballard soil but have a clayey subsoil. Included areas make up about 20 percent of the total acreage.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures is highly fractured, weathered rock mixed with soil material. Runoff is rapid, and the hazard of water erosion is slight.

The Ballard soil is very deep and well drained. It formed in alluvium derived dominantly from sandstone or shale. Typically, the surface layer is brown gravelly loam about 19 inches thick. The upper 7 inches of the subsoil is brown gravelly clay loam, and the lower 39 inches is light brown gravelly clay loam.

Permeability of the Ballard soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used for urban development.

The main limitation of this unit for urban development is the potential for shrinking and swelling. Concrete structures should be designed to overcome this limitation. This can be achieved by using blankets of crushed rock and sand beneath concrete structures, by using vapor barriers, or by increasing the strength of the concrete by prestressing or using additional reinforcing steel.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. As many trees as possible should be preserved during homesite development. Removal of gravel and cobbles in disturbed areas is needed for best landscaping results, particularly for lawns. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability unit IIIe-1 (14), nonirrigated.

202—Urban land-Xerorthents complex, 0 to 9 percent slopes. This map unit is on valley floors, on cut toe slopes, and on tidelands or in bay areas that are covered with fill. Elevation is 0 to 500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 55 to 62 degrees F, and the average frost-free period is 270 to 350 days.

This unit is 70 percent Urban land and 20 percent Xerorthents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hydraquents, saline, and Ballard, Blucher, Cole, Novato, and Reyes soils that have not been disturbed. These soils are in areas that are not filled, in yards, and in vacant lots. Also included are small areas of soils that have slope of more

than 9 percent and soils adjacent to the bay that are subject to brief periods of flooding during storms and high tides. Included areas make up about 10 percent of the total acreage.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures are rock fragments and soil material that is similar to that of the Xerorthents. Runoff is rapid, and the hazard of water erosion is slight.

Xerorthents consist of cut or fill areas, or both, that vary greatly in depth and drainage. The fill areas consist of variable amounts of soil material, gravel, broken cement, asphalt, rock, bay mud, and other solid material. In some places the original soils have been graded and the layers mixed. Extensive cuts have been made on toe slopes of uplands and on the low hills that extend into the valleys; consequently, the soil material has been mixed with crushed and broken rock.

The properties of Xerorthents are highly variable because of the kinds and amount of fill material in the profile or because of the amount of cutting and grading of the soils.

This unit is used for homesite, urban, and recreational development.

If this unit is used for homesite and urban development, the main limitations are the susceptibility of the soils to subsidence and the highly variable soil properties. Onsite investigation is needed. Areas of fill are not suitable as a base for structures until they have been compacted so that subsidence is minimized. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

The main limitations of Xerorthents for recreational development vary with the properties of the soils; therefore, onsite investigation is needed. In fill areas adjacent to the bay, poor drainage and the hazard of flooding are limitations. Other fill areas are limited by the solid waste, gravel, or clay that is mixed with the soil material. Cuts and fills may be limited by shallow depth. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIIIs (15), nonirrigated.

203—Xerorthents, fill. This map unit consists of soil material that has been moved mechanically and mixed. Most of this unit is in urban areas. Some fill areas contain varying amounts of rock, concrete, asphalt, and other material.

Typically, Xerorthents are loamy and are well drained. Permeability and available water capacity vary. Surface runoff is very rapid, and the hazard of erosion is moderate.

This unit is used primarily for urban development.

Because the properties of Xerorthents are variable, onsite investigation is needed in areas used for urban development. The soils are subject to subsidence.

This map unit is in capability subclass VIIIs.

204—Xerorthents-Urban land complex, 0 to 9 percent slopes. This map unit is on valley floors, on cut toe slopes, and on tidelands or in bay areas covered with fill. Elevation is 0 to 500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 55 to 62 degrees F, and the average frost-free period is 270 to 350 days.

This unit is 45 percent Xerorthents and 40 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hydraquents, saline, and Ballard, Blucher, Cole, Novato, and Reyes soils that have not been disturbed. These soils are in areas not filled, in yards, and in vacant lots. Also included are small areas of soils that have slope of more than 9 percent and soils adjacent to the bay that are subject to brief periods of flooding during storms and high tides. Included areas make up about 15 percent of the total acreage.

Xerorthents consist of cut or fill areas, or both, that vary greatly in depth and drainage. The fill areas consist of soil, gravel, broken cement, asphalt, rock, bay mud, and other material from urban construction. In some places the original soils have been graded and the layers mixed. Extensive cuts have been made on toe slopes of uplands and on the low hills that extend into the valleys; consequently, the soil material has been mixed with crushed and broken rock.

The properties of Xerorthents are highly variable because of the kinds and amount of fill material in the profile or because of the amount of cutting and grading of the soils.

Urban land consists of areas covered by roads, driveways, houses, parking lots, and other structures. Beneath these structures are rock fragments and soil material that is similar to that of the Xerorthents. Runoff is rapid, and the hazard of water erosion is slight.

This unit is used for homesite, urban, and recreational development.

This unit is suited to homesite and urban development. The main limitations are the susceptibility of the soils to subsidence and the hazard of erosion. Onsite investigation is needed because of the variability of the fill material.

Areas of fill are not suitable as a base for structures until they have been compacted to minimize subsidence. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulching and other erosion control practices are needed to minimize soil loss and protect young plants until the ground cover is well established.

The main limitations of Xerorthents for recreational development vary with the properties of the soils; therefore, onsite investigation is needed. In fill areas adjacent to the bay, poor drainage and the hazard of flooding are limitations. Other fill areas are limited by the solid waste, rocks, gravel, or clay that is mixed with the soil material. Cuts and fills may be limited by shallow depth. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining adequate plant cover.

This map unit is in capability subclass VIIIs (15), nonirrigated.

205—Yorkville clay loam, 9 to 15 percent slopes. This deep, moderately well drained soil is on rolling uplands. It formed in material derived from shale. Slopes are unstable, hummocky, and complex. The soil is characterized by slips, slides, seeps, and springs. Areas are irregular in shape and are 5 to 30 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is 240 to 270 days.

Typically, the surface layer is grayish brown clay loam about 14 inches thick. The subsoil is grayish brown, dark grayish brown, pale olive, and gray clay about 37 inches thick. Weathered shale is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of soils that are on concave side slopes and have slipped, Los Osos soils on concave side slopes, Rock outcrop on ridgetops, soils that are similar to the Yorkville soil but are less than 40 inches deep to bedrock, and Yorkville soils that have slope of less than 9 percent. Also included are small areas of Tocaloma soils on north-facing side slopes and in drainageways.

Permeability of this Yorkville soil is moderately slow to a depth of 14 inches and very slow below this depth. Available water capacity is high to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing.

The production of forage on this unit commonly is limited by the terracing and compaction caused by animal traffic along the contour. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Proper placement of livestock watering facilities and salt promotes good distribution of grazing. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess, burclover, and California oatgrass.

This map unit is in capability unit IIIe-3 (15), nonirrigated.

206—Yorkville clay loam, 15 to 30 percent slopes. This deep, moderately well drained soil is on hilly uplands. It formed in material derived from shale. Slopes are complex. Areas are irregular in shape and are 5 to 50 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is 240 to 270 days.

Typically, the surface layer is grayish brown clay loam about 14 inches thick. The subsoil is grayish brown, dark gray, and olive gray clay about 37 inches thick. Weathered shale is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of shallow, very gravelly soils on ridgetops, Los Osos soils on concave side slopes, Yorkville soils that have slope of less than 15 percent, Rock outcrop on ridgetops, and soils that have slipped and are on concave side slopes. Also included are small areas of soils that are similar to the Yorkville soil but are less than 40 inches deep to bedrock.

Permeability of this Yorkville soil is moderately slow to a depth of 14 inches and very slow below this depth. Available water capacity is high to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

The production of forage on this unit commonly is limited by the terracing and compaction caused by animal traffic along the contour. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Grazing distribution can be accomplished by proper placement of salt and watering facilities. The main limitations for seeding are steepness of slope and very slow permeability. Plants that tolerate seasonal wetness should be seeded. Grazing should be delayed

until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess and burclover.

This map unit is in capability unit IVe-3 (15), nonirrigated.

207—Yorkville clay loam, 30 to 50 percent slopes. This deep, moderately well drained soil is on uplands. It formed in material derived from shale. Slopes are complex. Areas are irregular in shape and are 10 to 80 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is 240 to 270 days.

Typically, the surface layer is grayish brown clay loam about 10 inches thick. The subsoil is grayish brown, dark gray, and olive gray clay about 35 inches thick. Weathered shale is at a depth of 45 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Included in this unit are small areas of shallow, very gravelly soils on ridgetops, Yorkville soils that have slope of more than 50 percent, Saurin soils on convex side slopes, Bonnydoon soils and Rock outcrop on ridgetops, soils that have slipped and are on concave side slopes, and soils that are similar to the Yorkville soil but are less than 40 inches deep to bedrock. Also included are small areas of Los Osos soils on concave side slopes.

Permeability of this Yorkville soil is moderately slow to a depth of 10 inches and very slow below this depth. Available water capacity is high to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing.

The production of forage on this unit commonly is limited by the terracing and compaction caused by animal traffic along the contour. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Mechanical treatment practices are not practical because of the instability of the soil in this unit and steepness of slope. Proper placement of livestock watering facilities and salt promotes good distribution of grazing. Grazing should be delayed until the soil is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess and burclover.

This map unit is in capability subclass VIe (15), nonirrigated.

208—Yorkville-Rock outcrop complex, 9 to 15 percent slopes. This map unit is on rolling uplands. Slopes are complex. Areas are irregular in shape and are 10 to 60 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is 240 to 270 days.

This unit is 60 percent Yorkville clay loam and 20 percent Rock outcrop. The Yorkville soil is on concave side slopes, and Rock outcrop is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bonnydoon soils on ridgetops, Saurin soils on convex side slopes, Los Osos soils on concave side slopes, Yorkville soils that have slope of less than 9 percent, and Tocaloma soils on north-facing side slopes and in drainageways. Also included are small areas of soils that are similar to the Yorkville soil but are less than 40 inches deep to bedrock. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Yorkville soil is deep and moderately well drained. It formed in material derived from shale. Typically, the surface layer is grayish brown clay loam about 14 inches thick. The subsoil is grayish brown, dark gray, and olive gray clay about 37 inches thick. Weathered shale is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Yorkville soil is moderately slow to a depth of 14 inches and very slow below this depth. Available water capacity is high to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop is exposed areas mainly of shale or sandstone but including some chert. The outcroppings range from 5 to 50 feet in diameter, and they are irregular in shape.

This unit is used for livestock grazing.

The production of forage on this unit is limited by the terracing and compaction caused by animal traffic along the contour. Mechanical treatment practices are not practical because of the stony surface and the steepness of slope. Proper placement of livestock watering facilities and salt promotes good distribution of grazing. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Loss of the surface layer results in a

severe decrease in productivity and in the potential of the soil to produce forage. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. The characteristic plant community on this unit is mainly soft chess and burclover.

This map unit is in capability unit IVe-3 (15), nonirrigated.

209—Yorkville-Rock outcrop complex, 15 to 30 percent slopes. This map unit is on hilly uplands. Slopes are complex. Areas are irregular in shape and are 10 to 75 acres in size. The native vegetation is mainly annual grasses and forbs. Elevation is 50 to 1,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 55 to 59 degrees F, and the average frost-free period is 240 to 270 days.

This unit is 60 percent Yorkville clay loam and 20 percent Rock outcrop. The Yorkville soil is on complex side slopes, and Rock outcrop is on ridgetops. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bonnydoon soils near the upper part of convex side slopes, Los Osos soils on concave side slopes, Saurin soils on convex side slopes, soils that have slipped and are on concave side slopes, soils that are similar to the Yorkville soil but are less than 40 inches deep to bedrock, and shallow, very gravelly soils on ridgetops. Also included are small areas of Yorkville soils that have slope of more than 30 percent. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Yorkville soil is deep and moderately well drained. It formed in material derived from shale. Typically, the surface layer is grayish brown clay loam about 14 inches thick. The subsoil is grayish brown, dark gray, and olive gray clay about 37 inches thick. Weathered shale is at a depth of 51 inches. Depth to bedrock ranges from 40 to 60 inches or more.

Permeability of the Yorkville soil is moderately slow to a depth of 14 inches and very slow below this depth. Available water capacity is high to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop is exposed areas mainly of shale or sandstone but including some chert. The outcroppings range from 5 to 50 feet in diameter, and they are irregular in shape.

This unit is used for livestock grazing.

The production of forage on this unit is limited by the terracing and compaction caused by animal traffic along the contour. Slope restricts access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Mechanical treatment practices are not practical because of the stony surface and the steepness of slope. Grazing should be delayed until the soil in this unit is firm enough to withstand grazing pressure. Livestock grazing should be managed to protect the soil from erosion. Erosion is reduced by maintaining an adequate plant cover and allowing sufficient plant residue to remain on the soil surface after grazing. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce forage. The characteristic plant community on this unit is mainly soft chess and burclover.

This map unit is in capability unit IVe-3 (15), nonirrigated.

Prime Farmland

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It must be used for producing either food or fiber or be available for these uses. Soil quality, length of growing season, and moisture supply are adequate to economically produce a sustained high yield of crops when managed properly. Prime farmland produces the highest yields with minimal energy and economic resources and causes the least disturbance to the environment.

Prime farmland commonly has an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and length of growing season are favorable and levels of acidity or alkalinity are acceptable. There are few, if any, rock fragments and the soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods and is not flooded during the growing season. Soils excluded only by a hazard of flooding may qualify for prime farmland if this limitation can be overcome. Onsite investigation is needed to determine the extent of this limitation.

About 5,945 acres, or nearly 2 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The following map units meet the soil requirements for prime farmland when irrigated. This list does not constitute a recommendation for a particular land use.

101 Ballard gravelly loam, 2 to 9 percent slopes
102 Ballard-Urban land complex, 0 to 9 percent slopes (excluding Urban land)
114 Cortina gravelly sandy loam, 0 to 5 percent slopes
186 Tomales fine sandy loam, 2 to 9 percent slopes
190 Tomales loam, 2 to 9 percent slopes
201 Urban land-Ballard complex, 0 to 9 percent slopes (excluding Urban land)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider impractical major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in

class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. The numbers used to designate units within the subclasses are as follows:

0.—Indicates that a problem or limitation is caused by stony, cobbly, or gravelly material in the substratum.

1.—Indicates that a problem or limitation is caused by slope or by actual or potential erosion hazard.

2.—Indicates that a problem or limitation of wetness is caused by poor drainage or flooding.

3.—Indicates that a problem or limitation of slow or very slow permeability of the subsoil or substratum is caused by a clayey subsoil or a substratum that is semiconsolidated.

4.—Indicates that a problem or limitation is caused by sandy or gravelly soils with a low available water holding capacity.

5.—Indicates that a problem of limitation is caused by a fine-textured or very fine-textured surface layer.

6.—Indicates that a problem or limitation is caused by salt or alkali.

7.—Indicates that a problem or limitation is caused by rocks, stones, or cobblestones.

8.—Indicates that a problem or limitation exists in the root zone, which generally is less than 40 inches over massive bedrock and lacks moisture for plants.

9.—Indicates that a problem or limitation is caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

No unit designations are given for soils in class I since the soil characteristics are similar for all soils in this class. Unit designations are not given for soils in classes V through VIII since these soils normally are not intensively managed for cropland.

The capability classification for each map unit is given in the section "Detailed Soil Map Units."

Major Land Resource Areas

In Marin County, capability classification of the soils in a map unit is further refined by designating the major land resource area. A land resource area is a broad geographic area that has a distinct combination of climate, soil, vegetation, management needs, and kinds of crops that can be grown (*3*). Parts of three of these areas are in Marin County: California Coastal Redwood Belt (4), Central California Coastal Valleys (14), and Central California Coast Range (15). The number of the resource area is in parentheses after the class, subclass, or unit designation in the capability classification. An example is IIIe-1 (15).

A soil in one resource area may have characteristics that are similar to those of a soil in another resource area, and they may have the same capability symbol; however, the climate, vegetation, suitable crops, and management practices needed may differ. For example, both capability subclass VIe (4) and VIe (15) have moderately deep soils. The soils in capability subclass VIe (4) are in the California Coastal Redwood Belt and are suited to forest vegetation, but those in capability subclass VIe (15) are in the Central California Coast Range and are suited to use as rangeland.

On the following pages are more detailed descriptions of the parts of the land resource areas included in Marin County.

Land resource area 4.—The California Coastal Redwood Belt part of this area is in the west-central part of the survey area. It is dominantly on gently sloping to very steep uplands. The natural vegetation is mainly Douglas-fir, redwood, and shrubs. Elevation ranges from 50 to 1,700 feet. The average annual precipitation is 30 to 50 inches, the average annual air temperature is 52 to 58 degrees F, and the average frost-free season is 275 to 365 days.

Most of the California Coastal Redwood Belt is administered by the National Park Service and Marin Municipal Water District. It is primarily used for recreation, watershed, and some homesite development. Water is impounded from this area by the Marin Municipal Water District for use in the county.

Land resource area 14.—The Central California Coastal Valleys part of this area is in the eastern part of the survey area and in narrow valleys. It is dominantly on flood plains, alluvial fans, and alluvial plains. The natural vegetation is mainly annual grasses, forbs, water-tolerant plants, and oak. Elevation ranges from 0 to 1,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 50 to 65 degrees F, and the average frost-free season is 200 to 350 days.

Most of the Central California Coastal Valleys is used for livestock grazing, oat hay production, pasture, and urban development. Most of the soils along the margins of the bay have been diked and drained and are used for oat hay production. The undrained areas along the bay are frequently inundated by tidal action.

Land resource area 15.—The Central California Coast Range part of this area is in the central and eastern parts of the survey area. It is made up of mountainous areas that dominantly are gently sloping to very steep. The natural vegetation is mainly annual grasses, forbs, oak, and brush. Elevation ranges from 0 to 2,500 feet. The average annual precipitation is 20 to 52 inches, the average annual temperature is 50 to 62 degrees F, and the average frost-free season is 230 to 365 days.

Most of the Central California Coast Range is used for livestock grazing, wildlife habitat, watershed, recreation,

and homesite development. Some areas are administered by the National Park Service and the State Park Service. Water for urban areas is provided by the Marin Municipal Water District.

Rangeland

This section was prepared by Franklyn E. Archuleta, range conservationist, Soil Conservation Service.

About 33 percent of Marin County is rangeland. More than half of the farm income is from livestock, principally dairy operations. Dairy, cow-calf, and sheep operations are dominant in the northern part of the county, and cow-calf operations are prevalent in the central part. Most of the western part of the county that is used for livestock is leased from the National Park Service. The average size of the ranches in the county is 600 acres.

Most dairy farmers supplement the forage produced on rangeland with hay and grain purchased from outside sources. In winter the native forage is often supplemented with hay and protein concentrate. Some ranchers creep-feed calves and yearlings to increase their market weight.

The properties of a soil strongly influence the natural vegetation that it can support. The Saurin and Tocaloma soils on the eastern side of the San Andreas fault are clay loam and loam and are moderately deep over sandstone and shale. The Saurin soils support annual grasses, and the total production is moderate. The Tocaloma soils are on north- and east-facing side slopes. They support a dense stand of hardwood trees, and the usable forage is limited because of the brush and tree canopy. The Inverness, Kehoe, Steinbeck, and Tomales soils, in the western part of the county, are loam and sandy loam and are moderately deep and deep. These soils support annual grasses, and the total production is moderate to high. Dunes are common along the coast, and the hazard of soil blowing is high. The green-feed period on rangeland is limited because of the distribution of rainfall.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 4 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 4 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the characteristic natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation produced by the characteristic plant community including vegetation that is highly palatable and unpalatable to livestock. Some of the vegetation may also be grazed extensively by wildlife.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

The major management concern on most rangeland is control of grazing so that the kinds and amounts of plants that make up the characteristic natural plant community are maintained or reestablished. Existing vegetation provides only approximately one-third of the forage that originally was produced, because the natural vegetation in many parts of the area has been greatly depleted by continued overgrazing. Much of the acreage that was once open grassland is now covered with brush, weeds, and hardwood trees. Soil blowing is a hazard on the sandy soils that are not adequately covered.

The response of plants to grazing depends on the time of the year that they are being used, the type of animal using them, and the intensity of use. Range trend is a determination of whether the proportion of desirable plants in a plant community is improving or deteriorating. The determining factors include plant vigor, abundance of seedlings, changes in composition, presence of plant residue, and stability of the soil.

Manipulating or reducing undesirable brush is an important management concern. The characteristic vegetation for a certain range site may be grass, oak,

and scattered brush, but because of some disturbance or mismanagement the site deteriorates to pure brush. Similarly, the characteristic vegetation may be a mixture of soft chess, wild oat, and burclover, but because of mismanagement it deteriorates to foxtail fescue, filaree, and tarweed. Brush should be managed to improve forage production and provide habitat for wildlife; however, on some soils the only characteristic plant community is thick stands of brush.

In some areas, such as those that support annuals, the natural characteristic vegetation is not the most productive as forage for livestock or big game. The characteristic vegetation for some sites is brush or timber, and for others it is dominantly wild oat and ripgut brome. These sites produce more soft chess and clover, which is better as forage for wildlife and livestock, if the plant community is below the potential.

Because the natural potential vegetation once consisted of perennials that have since been replaced by annuals, the term "characteristic vegetation" better describes the present vegetation.

Proper grazing use, which includes leaving adequate litter residue on the soil, is essential to control runoff and erosion and to enhance the value of the areas for wildlife habitat. Good range management based on the information in this survey and other rangeland inventory information should be used to maintain and improve forage production.

Woodland Management and Productivity

By John W. Bramhall, forester, Soil Conservation Service.

About 124,000 acres of Marin County is woodland. Of this, 7,000 acres is commercial and 117,000 acres is noncommercial. The majority of the forest land is publicly owned and is managed by either the National Park Service or the Marin Municipal Water District.

The species growing on the commercial woodland include redwood, Douglas-fir, California-laurel, and tanoak. The noncommercial woodland supports Pacific madrone, tanoak, and live oak. Isolated groves of bishop pine are in areas north of Tomales Bay. These hardwoods are all suitable for use as firewood. Willow and red alder grow in some areas along stream corridors.

Nearly all the forest land in Marin County is second growth. The timber has been cut for use as sawtimber or as fuel for San Francisco. The tanoak was used for the tanning industry, which once flourished in the county.

Soil, climate, relief, and aspect are all important in determining tree growth and the species of trees that make up the woodland overstory. Redwood normally grows near the coast, where the precipitation is supplemented by the frequent periods of fog in summer. It grows best and the trees are largest in small, narrow areas of alluvial soils adjacent to streams. Farther inland, where summer temperatures are higher and there is less fog, the number of redwood trees decreases. Douglas-fir and associated hardwoods are dominant inland.

The site index for Douglas-fir is higher on soils in the fog belt than on soils that are of comparable depth but are outside the fog belt (*11*). The site index and the quality of the trees on a given map unit vary because of the effect of such factors as soil depth, aspect, slope, rainfall, location in reference to the fog belt, and elevation.

Protection of young seedlings from grazing, fire, and insects and disease is needed for the trees to grow well and flourish.

Table 5 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 5, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of

slight indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 6 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The *total production* of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 6 also lists the common names of the *characteristic vegetation* on each soil and the percentage *composition*, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Recreation

By Dave Patterson, biologist, Soil Conservation Service.

Recreation is an important use of the land in Marin County. Approximately one-third of the county, or 111,000 acres, is federal, state, county, and city parks or recreational areas. The Point Reyes National Seashore and the Golden Gate National Recreation Area make up 96,000 acres and are administered by the National Park Service. This land provides recreation for the nearby, heavily populated San Francisco Bay area.

Recreational areas in the county range from the beaches and tidal flats bordering the Pacific Ocean and the San Francisco Bay to the rugged mountains of the Pacific Coast Range. These areas also have diverse and unique plant communities, including pickleweed salt marsh, large areas of grassland and brushland, and woodland that has spectacular stands of redwood and Douglas-fir.

Public and private recreational areas are used as paths and trails for hiking and horseback riding and as camping areas, playgrounds, and golf courses.

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example,

interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By Dave Patterson, biologist, Soil Conservation Service.

The varied and often contrasting natural environment of Marin County supports a wide range of wildlife habitat and a diversity of fish and wildlife species. Some of the major areas used for wildlife habitat include rocky Pacific Ocean shores, coastal beaches, coastal salt marsh, freshwater marsh, redwood and Douglas-fir forest land, broadleaf and live oak woodland, areas that support chaparral or streamside vegetation, annual grassland, and rural and urban land.

The parks in the county provide habitat for the exotic fallow deer of southern Europe and western Asia and the axis deer of India. The pickleweed areas of coastal salt marsh provide habitat for the salt marsh harvest mouse and the California clapper rail.

Ponds and streams support several species of fish including trout, largemouth black bass, bluegill sunfish, minnows, stickleback, channel catfish, bullhead, carp, and sculpin. Steelhead trout and salmon have very limited access from the ocean to coastal streams because of the natural and manmade obstacles and the small size of the streams. A diversity of amphibians including frogs, newts, salamanders, and skinks also use the aquatic habitat. Further examples of wildlife species and their habitat and general wildlife habitat management considerations for each map unit are given in the section "General Soil Map Units."

Planting adapted trees and shrubs in odd areas along roads, fences, and field borders provides food and cover for wildlife. Soils that are medium textured and are at least 4 feet deep are best suited to these plantings. With the exception of those on wet or moist soils, all shrubs and trees should receive adequate irrigation during the first 2 years of establishment. They should also be protected from livestock, and competition from weeds should be controlled. More information can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service or from nurserymen.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are

very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, hardinggrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are milkthistle, tarweed, filaree, soft chess, needlegrass, and wild oat.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, California-laurel, red alder, apple, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, pyracantha, and buckwheat.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, Douglas-fir, and cypress.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are chamise, manzanita, coyotebrush, and California sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, pickleweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include California quail, pheasant, meadowlark, field sparrow, cottontail, and skunk.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, band-tailed pigeon, wren-tit, woodpeckers, squirrels, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include black-tailed deer, desert mule deer, mourning dove, meadowlark, and California quail.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or

for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a

landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are

given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is

penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 16, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xeroll (*Xer*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argixerolls (*Argi*, meaning argillic horizon, plus *Xeroll*, the suborder of the Mollisols that have an Xeric moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Argixerolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, thermic Typic Argixerolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*9*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*10*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ballard Series

The Ballard series consists of very deep, well drained soils on alluvial fans and bench terraces. These soils formed in mixed alluvium derived from sedimentary and igneous rock. Slope is 0 to 9 percent.

The Ballard soils are fine-loamy, mixed, thermic Typic Argixerolls.

Typical pedon of Ballard gravelly loam, 2 to 9 percent slopes; about 1.2 miles west from intersection of Marshall-Petaluma Road, on Chileno Valley Road; in Petaluma Quadrangle.

Ap—0 to 7 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and few fine roots; many very fine interstitial pores; 25 percent pebbles 2 to 74 millimeters in diameter; medium acid; clear smooth boundary.

A12—7 to 19 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores and few very fine vesicular pores; 25 percent pebbles 2 to 74 millimeters in diameter; medium acid; clear wavy boundary.

B21t—19 to 26 inches; brown (10YR 5/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, friable, very sticky and plastic; common very fine and few fine roots; many very fine tubular and interstitial pores; few thin clay films lining pores and on faces of peds; 25 percent pebbles 2 to 74 millimeters in diameter; slightly acid; clear wavy boundary.

B22t—26 to 48 inches; light brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable, very sticky and plastic; common very fine roots; many very fine tubular and interstitial pores; common thin clay films lining pores and on faces of peds; 15 percent pebbles 2 to 74 millimeters in diameter; neutral; gradual wavy boundary.

B3t—48 to 65 inches; light brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine tubular and interstitial pores; few thin clay films lining pores and on faces of peds; 30 percent pebbles 2 to 74 millimeters in diameter; neutral.

Thickness of the solum is 60 inches or more. Reaction is medium acid to mildly alkaline. The content of gravel is 15 to 35 percent throughout the profile.

The Ap horizon has color of 10YR 4/2, 5/2, or 5/3 or of 7.5YR 5/2 or 5/4. It is 7 to 12 inches thick.

The Bt horizon has color of 10YR 5/3 or 6/4 or of 7.5YR 5/2, 5/4 or 6/4. It is gravelly sandy clay loam or gravelly clay loam.

The Ballard soils in the survey area are at a lower elevation, receive more precipitation, and have slightly more clay in the Bt horizon than is defined in the range for the series. These differences, however, do not greatly affect the use and management of the soils.

Barnabe Series

The Barnabe series consists of shallow, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 9 to 75 percent.

The Barnabe soils are loamy-skeletal, mixed, isomesic Lithic Haplustolls.

Typical pedon of a Barnabe very gravelly loam in an area of Cronkhite-Barnabe complex, 15 to 30 percent slopes; 1,800 feet southwest of the intersection of U.S. Highway 1 and Panoramic Highway; 200 feet east of fire road; in San Rafael Quadrangle.

A11—0 to 2 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure parting to weak fine granular; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common very fine and fine and few medium interstitial and tubular pores; 45 percent pebbles 2 to 74 millimeters in diameter; medium acid; clear smooth boundary.

A12—2 to 8 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark gray (10YR 3/1) moist; strong fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial and tubular pores; 45 percent pebbles 2 to 74 millimeters in diameter; slightly acid; clear smooth boundary.

B2t—8 to 16 inches; very dark grayish brown (10YR 3/2) very gravelly loam, black (10YR 2/1) moist; strong fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; 35 percent pebbles 2 to 74 millimeters in diameter; slightly acid; abrupt irregular boundary.

R—16 inches; fractured sandstone and shale.

Bedrock is at a depth of 10 to 20 inches. The profile is more than 35 percent gravel, and it has base saturation of 50 to 75 percent throughout.

The A1 horizon has color of 10YR 3/2, 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 5/2 or 5/4. It is 5 to 10 inches thick and is slightly acid or medium acid.

The Bt horizon has color of 10YR 3/2, 4/2, 4/3, 5/2, or 6/3 or of 7.5YR 4/2 or 4/4. It is slightly acid or medium acid.

Barnabe Variant

The Barnabe Variant consists of shallow, well drained soils on uplands. These soils formed in material derived from chert and sandstone. Slope is 15 to 75 percent.

The Barnabe Variant soils are loamy-skeletal, mixed, isomesic Lithic Haplustolls.

Typical pedon of a Barnabe Variant very gravelly loam in an area of Tamalpais-Barnabe Variant very gravelly loams, 50 to 75 percent slopes; in the Marin Headlands of Golden Gate National Recreational Area; about 2,000 feet south of the rifle range building, 150 feet east along

a fire road from the intersection of a paved road and the fire road, and 25 feet south of the fire road; in Point Bonita Quadrangle (inset on Double Point Quadrangle).

A11—0 to 2 inches; dark reddish brown (5YR 3/3) very gravelly loam, dark reddish brown (5YR 2.5/2) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine and fine roots; few medium tubular pores and many very fine and fine interstitial pores; 40 percent angular chert fragments; neutral; clear smooth boundary.

A12—2 to 5 inches; dark reddish brown (5YR 3/2) very gravelly loam, dark reddish brown (5YR 2.5/2) moist; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few medium tubular pores and many very fine and fine interstitial pores; 40 percent angular chert fragments; neutral; gradual smooth boundary.

B2t—5 to 13 inches; dark reddish brown (5YR 3/2) very gravelly loam, dark reddish brown (5YR 2.5/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few medium tubular pores and many very fine and fine interstitial pores; few thin clay films on faces of peds and lining pores; about 45 percent angular chert fragments; neutral; abrupt irregular boundary.

R—13 inches; hard, fractured radiolarian chert.

Bedrock is at a depth of 10 to 20 inches.

The A1 horizon has color of 5YR 3/2 or 3/3, 7.5YR 3/2, or 10YR 3/2 or 3/3. It is 4 to 8 inches thick. It is slightly acid or neutral and is 35 to 45 percent gravel.

The Bt horizon has color of 5YR 3/2, 7.5YR 3/2, or 10YR 3/2 or 3/3. It is slightly acid or neutral and is 45 to 55 percent gravel.

Bayview Series

The Bayview series consists of shallow, well drained soils on uplands. These soils formed in material derived from highly fractured siliceous shale and sandstone. Slope is 15 to 75 percent.

The Bayview soils are loamy-skeletal, mixed, isomesic Lithic Haplustolls.

Typical pedon of a Bayview very gravelly loam in an area of Pablo-Bayview complex, 50 to 75 percent slopes, in the Point Reyes National Seashore, about 0.7 mile west on Limantour Road from Bayview trailhead and about 120 feet south of Limantour Road; in Inverness Quadrangle.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure and moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; many fine and medium pores; about 35 percent angular siliceous shale fragments; medium acid; clear smooth boundary.

A12—2 to 7 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure and moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; common very fine tubular and interstitial pores; about 50 percent angular siliceous shale fragments; medium acid; clear wavy boundary.

B2t—7 to 14 inches; dark gray (10YR 4/1) very gravelly loam, black (10YR 2/1) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and few medium roots; many very fine tubular and interstitial pores and common vesicular pores; few thin clay films on faces of peds; about 40 percent angular siliceous shale fragments; medium acid; clear wavy boundary.

R—14 inches; hard, highly fractured siliceous shale.

Bedrock is at a depth of 10 to 20 inches. The difference in the mean soil temperature in summer and in winter varies from 7 to 9 degrees F. The profile is more than 1 percent organic matter.

The A1 horizon has color of 10YR 3/1, 3/2, 4/1, 4/2, or 5/1. It is 5 to 11 inches thick. The horizon is 35 to 50 percent gravel, and it has base saturation of 50 to 80 percent.

The B2t horizon has color of 10YR 3/1, 3/2, 4/1, 4/2, or 5/1. It is very gravelly loam or very gravelly clay loam. The horizon is 35 to 50 percent gravel, and it has base saturation of 50 to 60 percent.

Blucher Series

The Blucher series consists of very deep, somewhat poorly drained soils on alluvial fans and in basins. These soils formed in alluvium derived from various kinds of rock. Slope is 2 to 5 percent.

The Blucher soils are fine-loamy, mixed, thermic Fluvaquentic Haploxerolls.

Typical pedon of a Blucher silt loam in an area of Blucher-Cole complex, 2 to 5 percent slopes; about 3,500 feet east of Highway 101, on first private road south of San Antonio Creek, and 30 feet south of private road; in Petaluma River Quadrangle.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; many fine faint strong brown (7.5YR 5/6) mottles, strong brown (7.5YR 4/6) moist; moderate medium and coarse prismatic structure and moderate coarse and

very coarse subangular blocky; hard, friable, sticky and plastic; many very fine roots and common fine and medium roots; common very fine tubular and interstitial pores; medium acid; clear smooth boundary.

A12—7 to 16 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; few fine faint yellowish brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) moist; weak coarse and very coarse prismatic structure and moderate coarse and very coarse subangular blocky; hard, friable, sticky and plastic; common very fine and medium roots; many very fine and common fine and medium tubular pores; filled krotovinas; slightly acid; abrupt smooth boundary.

IIC1—16 to 23 inches; brown and pale brown (10YR 5/3, 6/3) silt loam, dark brown and dark grayish brown (10YR 3/3, 4/2) moist; moderate thin to very thick platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; common fine and medium and few coarse tubular pores; many thin strata of very fine sand and silt; moderately alkaline; clear smooth boundary.

IIIC2g—23 to 39 inches; gray and grayish brown (10YR 5/1, 5/2) silty clay loam, very dark gray and very dark grayish brown (10YR 3/1, 3/2) moist; many medium distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/6) moist; moderate medium to very coarse angular blocky structure; very hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; very fine strata of sand; moderately alkaline; gradual smooth boundary.

IIIC3g—39 to 60 inches; gray (10YR 6/1) clay loam, dark gray (10YR 4/1) moist; many medium distinct brown (7.5YR 5/4) mottles, dark brown (7.5YR 4/4) moist; moderate medium to very coarse angular blocky structure; very hard, firm, sticky and plastic; common very fine roots, mainly following vertical cracks; common very fine tubular pores; charcoal present; water table observed at a depth of 47 inches; mildly alkaline.

These soils are occasionally flooded from December through April. Reaction increases with depth, and clay content averages less than 35 percent. The solum is 12 to 20 inches thick.

The A horizon has color of 10YR 4/1, 4/2, 5/1, 5/2, or 5/3, and it has mottles of 10YR 5/4 or 5/6 or of 7.5YR 5/6. It is 5 to 17 inches thick.

The C horizon has color of 10YR 4/1, 5/1, 5/2, 5/3, 6/1, 6/2, or 6/3, 2.5Y 6/2, or 5Y 7/2. It has mottles of 10YR 4/4, 4/6, 5/6, 5/8, 6/4, or 6/8 or of 7.5YR 5/4, 5/6, or 5/8 in the lower part.

Bonnydoon Series

The Bonnydoon series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 15 to 75 percent.

The Bonnydoon soils are loamy, mixed, thermic, shallow Entic Haploxerolls.

Typical pedon of Bonnydoon gravelly loam, 30 to 75 percent slopes; about 1.3 miles north from Nicasio School on San Geronimo-Nicasio Road and 3,500 feet west of the road; in San Geronimo Quadrangle.

A11—0 to 3 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong very fine, fine, and medium subangular blocky structure parting to strong very fine and fine granular; hard, friable, slightly sticky and plastic; many very fine and fine roots; common very fine and fine interstitial and tubular pores; 30 percent gravel; slightly acid; clear smooth boundary.

A12—3 to 9 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; common very fine and fine interstitial and tubular pores; 30 percent gravel; medium acid; gradual wavy boundary.

A13—9 to 15 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; strong fine and medium subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; 20 percent gravel; medium acid; abrupt irregular boundary.

Cr—15 inches; fractured sandstone.

The profile is 15 to 35 percent gravel throughout. The A1 horizon has color of 10YR 5/2 or 5/3. It is 7 to 20 inches thick and is slightly acid or medium acid. In some places a B2 or C horizon overlies the fractured bedrock. Bedrock is at a depth of 10 to 20 inches.

Bonnydoon Variant

The Bonnydoon Variant consists of shallow, well drained soils on uplands. These soils formed in material derived from igneous and metamorphic rock. Slope is 30 to 75 percent.

The Bonnydoon Variant soils are loamy, mixed, thermic Lithic Haploxerolls.

Typical pedon of a Bonnydoon Variant loam in an area of Gilroy-Gilroy Variant-Bonnydoon Variant loams, 30 to 50 percent slopes; in an open space north of San Marin; about 1.6 miles northeast of dirt road, from gate at end of San Andreas Drive, and 500 feet north of dirt road; in Petaluma River Quadrangle.

A11—0 to 9 inches; brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine interstitial pores and common very fine and fine vesicular and tubular pores; 3 to 5 percent pebbles 2 to 10 millimeters in diameter; neutral; abrupt smooth boundary.
A12—9 to 18 inches; brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) moist; moderate very fine and fine subangular blocky structure and moderate very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine interstitial pores and few very fine tubular pores; neutral; abrupt irregular boundary.
R—18 inches; hard, fractured andesite that does not slake in water; soil material in cracks.

Bedrock is at a depth of 10 to 20 inches. The A1 horizon has color of 7.5YR 5/2 or 5/4. It is 10 to 20 inches thick. The horizon is 18 to 25 percent clay and is slightly acid or neutral.

Bressa Variant

The Bressa Variant consists of moderately deep, well drained soils on uplands. These soils formed in material derived from conglomerate. Slope is 30 to 50 percent.

The Bressa Variant soils are fine-loamy, mixed, mesic Mollic Haploxeralfs.

Typical pedon of a Bressa Variant gravelly loam in an area of Bressa Variant-McMullin Variant complex, 30 to 50 percent slopes; about 3,500 feet north on private road at Bahia Valley Memorial Park and 75 feet west of road; in Petaluma River Quadrangle.

A1—0 to 4 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; common very fine tubular and interstitial pores; 25 percent rounded pebbles 2 to 25 millimeters in diameter; neutral; abrupt smooth boundary.
B11—4 to 15 inches; brown (7.5YR 5/4) gravelly sandy clay loam, brown and dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and common fine tubular pores and common fine interstitial pores; 20 percent rounded pebbles 2 to 25 millimeters in diameter; very strongly acid; clear wavy boundary.
B12t—15 to 25 inches; brown (7.5YR 5/4) gravelly sandy clay loam, brown and dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots and common medium and coarse roots; many very fine and fine tubular pores and common fine interstitial pores; few thin clay films on peds and lining pores; 24 percent rounded pebbles 2 to 25 millimeters in diameter; slightly acid; abrupt irregular boundary.
B2t—25 to 30 inches; strong brown (7.5YR 5/6) sandy clay loam, brown (7.5YR 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots and common fine and medium roots; common very fine and few fine tubular pores; 10 percent rounded pebbles 2 to 25 millimeters in diameter; common thin and moderately thick clay films as bridges and on peds; neutral; abrupt irregular boundary.
Cr—30 inches; weathered conglomerate; matrix is easily dug with hand tools.

Bedrock is at a depth of 20 to 40 inches. The profile is slightly acid to very strongly acid, decreasing in acidity with depth. The profile is 10 to 35 percent gravel throughout.

The A1 horizon has color of 10YR 5/2 or 5/3 or of 7.5YR 5/2 or 5/4. It is 2 to 9 inches thick.

The Bt horizon has color of 7.5YR 5/4 or of 5YR 5/3 or 5/4. It is sandy clay loam or gravelly sandy clay loam.

Centissima Series

The Centissima series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 15 to 75 percent.

The Centissima soils are fine-loamy, mixed, isomesic Typic Dystropepts.

Typical pedon of a Centissima loam in an area of Centissima-Barnabe complex, 15 to 30 percent slopes; about 1 mile north on Highway 1, from Dog Town, 0.8 mile east on fire trail and 20 feet south of fire trail in the Point Reyes National Seashore; in Bolinas Quadrangle.

O—2 inches to 0; decomposed duff and litter.
A11—0 to 6 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial and tubular pores; slightly acid; gradual wavy boundary.
A12—6 to 15 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine and few medium interstitial and tubular pores; slightly acid; clear irregular boundary.

B2t—15 to 22 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine and few medium interstitial and tubular pores; few thin clay films on faces of peds and lining pores; medium acid; clear irregular boundary.

C1—22 to 29 inches; light brown (7.5YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; many very fine and fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; 20 percent pebbles 2 to 74 millimeters in diameter; medium acid; clear wavy boundary.

C2—29 to 33 inches; light brown (7.5YR 6/4) and yellowish red (5YR 5/6) very gravelly clay loam, strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common very fine and fine interstitial and tubular pores; common thin clay films on faces of peds and lining pores; 45 percent pebbles 2 to 74 millimeters in diameter; slightly acid; clear smooth boundary.

C3r—33 inches; weathered sandstone and shale.

Bedrock is at a depth of 20 to 40 inches. The profile is slightly acid or medium acid and has base saturation of less than 50 percent throughout.

The A11 horizon has color of 10YR 4/2, 4/3, or 5/3 or of 7.5YR 3/2, 4/2, 4/4, 5/2, or 5/4. It is 3 to 6 inches thick.

The Bt horizon has color of 10YR 6/3, 6/4, or 6/6. It is loam or gravelly loam.

The C horizon has color of 7.5YR 6/4 or 10YR 6/4. The upper part is loam or gravelly clay loam and is 5 to 35 percent gravel. The lower part is 35 to 50 percent gravel.

Clear Lake Series

The Clear Lake series consists of very deep, poorly drained soils in basins. These soils formed in fine textured mixed alluvium. Slope is 0 to 2 percent.

The Clear Lake soils are fine, montmorillonitic, thermic Typic Pelloxererts.

Typical pedon of a Clear Lake clay; about 1.4 miles south on Marshall-Petaluma Road, from intersection of Walker Creek, and 100 feet south of road; in Point Reyes Quadrangle.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure parting to moderate medium granular; very hard, firm, very sticky and very plastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly acid; abrupt smooth boundary.

A12—8 to 28 inches; very dark gray (10YR 3/1) clay, black (2.5Y 2/2) moist; strong fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine interstitial pores; many small and medium intersecting slickensides; mildly alkaline; gradual wavy boundary.

AC—28 to 42 inches; dark gray (5Y 4/1) clay, black (10YR 2/1) and very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine interstitial pores; many small and medium intersecting slickensides; moderately alkaline; clear wavy boundary.

C—42 to 65 inches; gray (5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) moist; many medium prominent yellowish brown (10YR 5/6) mottles, yellowish brown (10YR 5/8) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine interstitial pores; moderately alkaline.

The solum is 30 to 50 inches thick. Unless the soils are irrigated, cracks 1/2 inch to 1.5 inches wide extend to a depth of 45 inches or more and remain open all summer and until it rains in fall.

The A horizon has color of 10YR 3/1 or 4/1 or of 5Y 4/1. It is slightly acid to moderately alkaline.

The C horizon has color of 5Y 5/1 or 6/1. It has lime in places.

Cole Series

The Cole series consists of very deep, somewhat poorly drained soils in valley basins and on alluvial fans. These soils formed in alluvium derived from various kinds of rock. Slope is 2 to 5 percent.

The Cole soils are fine, mixed, thermic Pachic Argixerolls.

Typical pedon of a Cole clay loam in an area of Blucher-Cole complex, 2 to 5 percent slopes; about 4,600 feet north on San Geronimo-Nicasio Road, from Nicasio School; 1,000 feet east on private road and 30 feet south of private road; in San Geronimo Quadrangle.

A11—0 to 5 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; common medium and large prominent brown (7.5YR 5/4) mottles, dark reddish brown (5YR 3/4) moist; moderate medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; many very fine roots and common medium roots; common very fine and fine tubular and interstitial pores and few coarse vesicular pores; few vertical cracks; medium acid; abrupt smooth boundary.

A12—5 to 14 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; common fine distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; many very fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear smooth boundary.

B21t—14 to 27 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; common fine distinct yellowish brown (10YR 5/6) mottles, dark brown (10YR 3/3) moist; moderate medium angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on faces of peds and lining pores; neutral; gradual smooth boundary.

B22t—27 to 42 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium and coarse angular blocky; very hard, firm, sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on faces of peds and lining pores; mildly alkaline; clear wavy boundary.

C1—42 to 54 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; common fine distinct mottles that are light olive brown (2.5Y 5/6) when moist, common medium distinct mottles that are olive brown (2.5Y 4/4) when moist; weak medium and coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many fine and medium tubular and interstitial pores; few moderately thick clay films on faces of peds and lining pores; moderately alkaline; gradual smooth boundary.

C2—54 to 64 inches; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; many fine distinct mottles that are yellowish brown (10YR 5/8 when moist, common medium distinct mottles that are dark brown (10YR 3/3) when moist; massive; very hard, firm, sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films lining pores; moderately alkaline.

Reaction of the profile generally increases with increasing depth. The solum is 30 to 50 inches thick.

The A1 horizon has color of 10YR 4/1, 5/1, or 5/2 or of 2.5Y 4/1, 5/1, or 5/2. It is 10 to 20 inches thick. Mottles that have color of 7.5YR 5/4 or 5/6 or of 10YR 5/6 or 5/8 are present in some pedons.

The Bt horizon has color of 10YR 3/1, 4/1, or 4/2, of 2.5Y 4/2, or of N 3/0 or 4/0. It is silty clay loam or silty clay and is 35 to 45 percent clay. Mottles that have color of 10YR 5/6, 5/8, or 6/6 are present in some pedons.

Cortina Series

The Cortina series consists of very deep, somewhat excessively drained soils on valley floors and along streams. These soils formed in recent alluvium derived from various kinds of rock. Slope is 0 to 5 percent.

The Cortina soils are loamy-skeletal, mixed, nonacid, thermic Typic Xerofluvents.

Typical pedon of Cortina gravelly sandy loam, 0 to 5 percent slopes; about 4,300 feet south on private road to Soulajule Reservoir, from Marshall-Petaluma Road, and 300 feet east of private road; 30 feet west of Arroyo Creek; in Point Reyes N.E. Quadrangle.

A1—0 to 10 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular and interstitial pores; 15 percent pebbles 2 to 74 millimeters in diameter; medium acid; clear wavy boundary.

C1—10 to 44 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 4/3) moist; massive; loose; many very fine and fine roots; many very fine interstitial pores; 60 percent pebbles 2 to 74 millimeters in diameter; neutral; clear wavy boundary.

C2—44 to 60 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose; common very fine and fine roots; many very fine interstitial pores; 20 percent pebbles 2 to 74 millimeters in diameter; neutral.

The solum is 10 to 30 inches thick. The control section is 35 to 60 percent gravel. The profile is medium acid to neutral.

The A horizon has color of 10YR 6/3 or 6/4. It is 7 to 15 inches thick. The horizon is 15 to 35 percent gravel in most pedons, but it is less than 15 percent in some pedons.

The C horizon has color of 10YR 6/3 or 6/4. It is 35 to 60 percent gravel. Individual strata are sand, loamy sand, or sandy loam.

Cronkhite Series

The Cronkhite series consists of deep, moderately well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 9 to 75 percent.

The Cronkhite soils are fine, montmorillonitic, isomesic Pachic Argiustolls.

Typical pedon of a Cronkhite loam in an area of Cronkhite-Barnabe complex, 30 to 50 percent slopes; about 4,500 feet northwest on Muir Woods Road, from junction of Highway 1, and 100 feet east of Muir Woods Road; in Point Bonita Quadrangle.

A11—0 to 9 inches; brown (10YR 5/3) loam, very dark gray (10YR 3/1) moist; strong very fine, fine, and medium subangular blocky structure; extremely hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; common very fine tubular and interstitial pores and common fine tubular and vesicular pores; cracks 0.5 centimeter wide and 6 to 12 inches apart; slightly acid; clear smooth boundary.

A12—9 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine, fine, and medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and vesicular pores; cracks 0.5 centimeter wide and 6 to 12 inches apart; slightly acid; gradual smooth boundary.

A3—15 to 26 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine subangular blocky structure; extremely hard, friable, sticky and plastic; common very fine roots; common very fine interstitial and tubular pores and common fine and medium tubular and vesicular pores; common moderately thick clay films lining pores and as pressure cutans; cracks 0.5 centimeter wide and about 6 to 12 inches apart; slightly acid; abrupt smooth boundary.

B2t—26 to 37 inches; mixed yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) clay, mixed dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse angular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots and few fine roots; common very fine tubular, vesicular, and interstitial pores; many moderately thick clay films lining pores and as pressure cutans; cracks 1 centimeter wide and about 4 to 8 inches apart; slightly acid; gradual wavy boundary.

B3t—37 to 45 inches; yellowish brown (10YR 5/8) clay loam, dark yellowish brown (10YR 4/4) moist; strong medium and coarse angular blocky structure; very hard, friable, sticky and plastic; common very fine roots and few fine roots; common very fine tubular, vesicular, and interstitial pores; many moderately thick clay films lining pores and as pressure cutans; cracks 1 centimeter wide and about 4 to 8 inches apart; neutral; gradual irregular boundary.

Cr—45 inches; highly shattered sandstone; prominent manganese stains.

Bedrock is at a depth of 40 to 60 inches or more. The solum is 40 to 60 inches thick or more. The difference between the mean summer soil temperature and the mean winter soil temperature is 7 to 9 degrees F.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. It is 20 to 30 inches thick and is slightly acid or neutral. Cracks 0.5 centimeter wide that extend into the upper part of the Bt horizon are in some pedons.

The Bt horizon has mixed colors of 10YR 5/6, 5/8, or 6/6 or of 7.5YR 4/2 or 5/2. It is clay or clay loam and is more than 35 percent clay. The horizon is slightly acid or neutral.

Dipsea Series

The Dipsea series consists of deep, well drained soils on uplands. These soils formed in material derived from fine-grained sandstone and shale. Slope is 30 to 75 percent.

The Dipsea soils are loamy-skeletal, mixed, isomesic Typic Tropudalfs.

Typical pedon of a Dipsea very gravelly loam in an area of Dipsea-Barnabe very gravelly loams, 50 to 75 percent slopes; 1.2 miles northwest of the peak of Pine Mountain and 2 miles southeast of the spillway of Peter's Dam, on Kent Lake; in Bolinas Quadrangle.

O1—2 inches to 0; leaves and duff.

A11—0 to 4 inches; dark brown (7.5YR 3/2) very gravelly loam, dark reddish brown (5YR 3/2) moist; strong very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; 35 percent pebbles; slightly acid; clear smooth boundary.

A12—4 to 8 inches; dark brown (7.5YR 4/4) very gravelly loam, dark reddish brown (5YR 3/2) moist; strong very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial, vesicular, and tubular pores; 35 percent pebbles; medium acid; clear smooth boundary.

B1t—8 to 12 inches; brown (7.5YR 5/4) very gravelly loam, dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial, vesicular, and tubular pores; few thin clay films on faces of peds and lining pores; 45 percent pebbles; medium acid; gradual wavy boundary.

B2t—12 to 25 inches; brown (7.5YR 5/4) very gravelly clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial, vesicular, and tubular pores; few thin clay films on faces of peds and lining pores; 50 percent pebbles; strongly acid; gradual wavy boundary.

B3—25 to 48 inches; light brown (7.5YR 6/4) very gravelly loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky

structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine interstitial, vesicular, and tubular pores; 55 percent pebbles; strongly acid; clear irregular boundary.

Cr—48 inches; fractured sandstone.

Bedrock is at a depth of 40 to 60 inches or more. The difference between the mean summer soil temperature and the mean winter soil temperature is 5 to 8 degrees F. Base saturation averages less than 50 percent but is 35 to 60 percent. The profile averages 35 to 55 percent gravel.

The A1 horizon has color of 7.5YR 3/2, 4/2, or 4/4 or of 5YR 4/3, 4/4, 5/3, or 5/4. It is 6 to 12 inches thick and is 15 to 27 percent clay.

The Bt horizon has color of 5YR 4/3, 4/4, 4/6, 5/3, 5/4, 5/6, 5/8, 6/4, 6/6, 6/8, 7/6, or 7/8 or of 7.5YR 5/2, 5/4, or 6/4. It is very gravelly loam or very gravelly clay loam and is 25 to 35 percent clay.

Felton Variant

The Felton Variant consists of deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 9 to 75 percent.

The Felton Variant soils are fine, mixed, mesic Pachic Ultic Argixerolls.

Typical pedon of a Felton Variant loam in an area of Felton Variant-Soulajule complex, 9 to 15 percent slopes; about 2.2 miles east on Marshall-Petaluma Road, from Highway 1, and 500 feet north of Marshall-Petaluma Road; in Point Reyes N.E. Quadrangle.

Ap—0 to 9 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine and fine interstitial pores; slightly acid; clear smooth boundary.

A12—9 to 23 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine and fine interstitial pores; slightly acid; clear wavy boundary.

B21t—23 to 34 inches; yellowish brown (10YR 5/4) clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine and fine tubular, vesicular, and interstitial pores; few thin clay films lining pores; slightly acid; clear wavy boundary.

B22t—34 to 47 inches; strong brown (7.5YR 5/6) clay, yellowish red (5YR 4/6) and reddish brown (5YR 4/3) moist; massive; very hard, firm, very sticky and very plastic; few very fine roots; few very fine interstitial pores; many moderately thick clay films lining pores; neutral; gradual wavy boundary.

Cr—47 inches; soft shale.

Bedrock is at a depth of 40 to 60 inches or more.

The A1 horizon has color of 10YR 4/3, 4/4, or 5/3. It is 20 to 30 inches thick and is slightly acid or neutral. Base saturation is 50 to 60 percent.

The Bt horizon has color of 10YR 4/3, 5/4, or 5/6 or of 7.5YR 5/4 or 5/6. It is clay loam or clay and is 27 to 50 percent clay. The horizon is slightly acid or neutral. Base saturation is 60 to 75 percent.

Gilroy Series

The Gilroy series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from igneous and metamorphic rock. Slope is 30 to 75 percent.

The Gilroy soils are fine-loamy, mixed, thermic Typic Argixerolls.

Typical pedon of a Gilroy loam in an area of Gilroy-Gilroy Variant-Bonnydoon Variant loams, 30 to 50 percent slopes, in an open area just north of San Marin; about 1.7 miles northeast on dirt road, from gate at end of San Andreas Drive in San Marin, and 300 feet north of dirt road; in Petaluma River Quadrangle.

A11—0 to 5 inches; brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; neutral; clear smooth boundary.

A12—5 to 12 inches; brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores and few coarse tubular pores; neutral; gradual smooth boundary.

B21t—12 to 21 inches; reddish brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine tubular and interstitial pores and few coarse tubular pores; few thin clay films on faces of peds and lining pores; neutral; gradual smooth boundary.

B22t—21 to 30 inches; yellowish red (5YR 5/6) very gravelly clay loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine tubular and interstitial pores and few coarse tubular pores; few thin clay films on faces of peds and lining pores; 50 percent pebbles 2 to 74 millimeters in diameter; neutral; abrupt irregular boundary.

R—30 inches; fractured, unweathered andesite.

Bedrock is at a depth of 20 to 40 inches.

The A horizon has color of 7.5YR 4/2, 5/2, or 5/4 or of 5YR 5/2 or 5/3. It is 8 to 15 inches thick and is medium acid to neutral.

The Bt horizon has color of 5YR 4/6, 5/3, 5/4, or 5/6. It is 35 to 50 percent gravel and is medium acid to neutral.

Gilroy Variant

The Gilroy Variant consists of deep, well drained soils on uplands. These soils formed in material derived from igneous and metamorphic rock. Slope is 30 to 75 percent.

The Gilroy Variant soils are fine-loamy, mixed, thermic Typic Argixerolls.

Typical pedon of a Gilroy Variant loam in an area of Gilroy-Gilroy-Variant-Bonnydoon Variant loams, 30 to 50 percent slopes; in an open area just north of San Marin; about 1.9 miles northeast on dirt road, from gate at end of San Andreas Drive in San Marin, and 50 feet north of dirt road; in Petaluma River Quadrangle.

A11—0 to 6 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 3/2) moist; the upper 1.5 inches has moderate very thin and thin platy structure, and the lower part has moderate very fine, fine, and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine interstitial and vesicular pores and few very fine tubular pores; neutral; abrupt wavy boundary.

A12—6 to 21 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and medium tubular pores, common very fine vesicular pores, and many very fine, fine, and medium interstitial pores; few thin clay films on faces of peds and lining pores; less than 2 percent pebbles 2 to 20 millimeters in diameter; neutral; clear wavy boundary.

B21t—21 to 30 inches; brown (7.5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/3) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine and fine tubular pores, many very fine vesicular pores, and few fine and medium interstitial pores; few thin clay films on faces of peds and lining pores; common moderately thick and thick clay films on peds; 10 percent stones 3 to 5 inches in diameter; neutral; abrupt wavy boundary.

B22t—30 to 45 inches; brown (7.5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular and vesicular pores; many moderately thick clay films and few thick clay films on faces of peds and lining pores; 15 to 20 percent pebbles 2 to 75 millimeters in diameter and 5 percent stones 3 to 5 inches in diameter; neutral; abrupt irregular boundary.

R—45 inches; fractured andesite that does not slake in water.

Bedrock is at a depth of 40 to 60 inches or more.

The A1 horizon has color of 7.5YR 4/2, 5/2, or 5/4 or of 5YR 5/2 or 5/3. It is 5 to 21 inches thick. The content of organic matter is more than 1 percent to a depth of 20 inches. The horizon is medium acid to neutral.

The Bt horizon has color of 5YR 4/6, 5/3, 5/4, or 5/6 or of 7.5YR 5/4. The upper part of the horizon is 0 to 10 percent stones 3 to 5 inches in diameter, and the lower part is 15 to 20 percent pebbles.

Henneke Series

The Henneke series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in material derived from serpentinite. Slope is 15 to 50 percent.

The Henneke soils are clayey-skeletal, serpentinitic, thermic Lithic Argixerolls.

Typical pedon of Henneke stony clay loam, 15 to 50 percent slopes; about 1.3 miles southeast of Green Hills and 10 feet west of Pine Mountain-Truck Road, about 1 mile southwest of Woodacre and 10 feet west of dirt road; in Bolinas Quadrangle.

A1—0 to 3 inches; dark reddish brown (5YR 3/3) stony clay loam, dark reddish brown (5YR 2/2) moist; strong very fine subangular blocky structure; hard, very friable, sticky and plastic; common very fine, fine, and medium roots; common very fine tubular pores and few very fine interstitial pores; neutral; clear smooth boundary.

B1t—3 to 9 inches; dark reddish brown (5YR 3/2) very cobbly clay loam, dark reddish brown (5YR 2/2) moist; moderate very fine, fine, and medium subangular blocky structure; hard, friable, very sticky and plastic; common very fine roots; common very fine tubular pores; many thin clay films on faces of peds and lining pores; neutral; gradual smooth boundary.

B2t—9 to 16 inches; dark brown (7.5YR 3/2) very cobbly clay, dark brown (7.5YR 3/2) moist; strong fine and medium subangular blocky structure; very hard, very firm, very sticky and plastic; common very fine roots; few very fine tubular pores; many thin clay films on faces of peds and lining pores; neutral; abrupt wavy boundary.

R—16 inches; serpentinite.

More than 50 percent of the surface is covered with stones. Weathered serpentinite is at a depth of 10 to 20 inches.

The A horizon has color of 5YR 2/2, 3/1, 3/2, or 3/3; 7.5YR 4/2 or 4/4; or 2.5YR 3/2. It is 3 to 7 inches thick. The horizon is 35 to 50 percent rock fragments and is neutral or slightly acid.

The Bt horizon has color of 5YR 2/2, 3/2, or 3/3 or of 7.5YR 3/2. It is clay loam or clay and is more than 35 percent clay and 35 to 50 percent cobbles. The horizon is neutral or mildly alkaline.

Inverness Series

The Inverness series consists of deep, well drained soils on uplands. These soils formed in material derived from quartz-diorite. Slope is 9 to 75 percent.

The Inverness soils are fine-loamy, mixed, isomesic Ultic Haplustalfs.

Typical pedon of Inverness loam, 9 to 15 percent slopes, in the Point Reyes National Seashore; about 3,200 feet northwest from Radio Range Station on Mount Vision Road, 500 feet southwest from Mount Vision Road on fire road, and 20 feet north of fire road near locked gate on Mount Vision Road; in Inverness Quadrangle.

A11—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; strong very fine, fine, and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; few very fine and fine tubular and interstitial pores; strongly acid; gradual smooth boundary.

A12—10 to 22 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; strong fine, medium, and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; common very fine and fine tubular and interstitial pores; strongly acid; clear smooth boundary.

B2t—22 to 29 inches; brown (10YR 5/3) clay loam, very dark brown (10YR 2/2) moist; strong medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; few thin clay films on faces of peds and lining pores; strongly acid; clear smooth boundary.

B3t—29 to 36 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown and very dark grayish brown (10YR 4/4, 3/2) moist; strong medium and coarse subangular blocky structure; hard, very friable, sticky and plastic; common very fine and fine roots; few very fine and fine interstitial pores and common very fine and fine tubular pores; common thin clay films on faces of peds and lining pores; strongly acid; clear smooth boundary.

C1—36 to 47 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; medium acid; clear smooth boundary.

C2—47 to 60 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; medium acid; gradual smooth boundary.

C3r—60 inches; very pale brown (10YR 7/4) highly weathered quartz-diorite.

Highly weathered quartz-diorite is at a depth of 40 to 60 inches or more. The difference between the mean summer soil temperature and the mean winter soil temperature is 7 to 9 degrees F. The profile is strongly acid or medium acid, increasing in acidity with increasing depth. Base saturation is less than 50 percent throughout the profile. The solum is 18 to 40 inches thick.

The A1 horizon has color of 10YR 3/2, 4/1, or 4/2. It is 20 to 30 inches thick.

The Bt horizon has color of 10YR 4/2, 5/2, 5/3, 6/2, 6/3, or 6/4. It is loam or clay loam and is 25 to 35 percent clay.

The C horizon has color of 10YR 6/4, 7/3, or 7/4. It is loam or sandy loam. The horizon is about 5 to 20 percent mica flakes.

Kehoe Series

The Kehoe series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone. Slope is 9 to 30 percent.

The Kehoe soils are fine-loamy, mixed, isomesic Pachic Haplustolls.

Typical pedon of Kehoe loam, 9 to 15 percent slopes; in the Point Reyes National Seashore, on Tomales Point; about 1.3 miles north of the Kehoe Ranch milkhouse, on Pierce Point Road, and 150 feet west of the road in an area of pasture; in Tomales Quadrangle.

A11—0 to 11 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; medium acid; gradual wavy boundary.

A12—11 to 23 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky

and plastic; many very fine and fine roots and few medium roots; few very fine tubular pores, common fine and medium vesicular pores, and many very fine interstitial pores; medium acid; gradual wavy boundary.

A13—23 to 34 inches; dark grayish brown and very dark grayish brown (10YR 4/2, 3/2) loam, very dark grayish brown and very dark brown (10YR 3/2, 2/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and medium tubular and vesicular pores; medium acid; abrupt wavy boundary.

C1—34 to 38 inches; very pale brown (10YR 7/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and medium vesicular and tubular pores; medium acid; abrupt wavy boundary.

Cr—38 inches; massive; soft, weathered sandstone.

Soft, weathered sandstone is at a depth of 20 to 40 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is 6 to 9 degrees F. The content of organic matter is more than 1 percent to a depth of 30 inches. The profile is medium acid or slightly acid. It averages 18 to 25 percent clay.

The A1 horizon has color of 10YR 3/1, 3/2, 3/3, 4/1, or 4/2. It is 20 to 34 inches thick.

The C1 horizon has color of 10YR 6/2, 6/3, 7/2, or 7/3. It is fine sandy loam, sandy loam, or loam.

Kehoe Variant

The Kehoe Variant consists of deep, well drained soils on uplands. These soils formed in material derived from quartz-diorite. Slope is 9 to 50 percent.

The Kehoe Variant soils are coarse-loamy, mixed, isomesic Pachic Haplustolls.

Typical pedon of Kehoe Variant coarse sandy loam, 9 to 15 percent slopes; in the Point Reyes National Seashore, on Tomales Point; about 2 miles north on dirt road, from the end of Pierce Point Ranch headquarters, and 70 feet east of the dirt road; in Tomales Quadrangle.

A11—0 to 8 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure and weak fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular and interstitial pores; medium acid; gradual smooth boundary.

A12—8 to 25 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure and weak fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; many very fine and fine tubular and interstitial pores; medium acid; diffuse wavy boundary.

A13—25 to 41 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure and weak fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on faces of peds and as bridges; medium acid; clear irregular boundary.

C1—41 to 49 inches; brown and very pale brown (10YR 5/3, 7/3) loamy coarse sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films as bridges; medium acid; clear smooth boundary.

Cr—49 to 80 inches; sandy, weathered quartz-diorite; massive; few thin clay coatings in cracks.

Weathered quartz-diorite is at a depth of 40 to 60 inches or more. The difference between the mean summer soil temperature and the mean winter soil temperature is 6 to 9 degrees F. The profile is neutral to medium acid, increasing in acidity with increasing depth. It is less than 18 percent clay. Base saturation is 50 to 75 percent throughout the profile.

The A1 horizon has color of 10YR 4/1, 4/2, 5/1, or 5/2. It is 20 to 30 inches thick. The horizon is 20 to 30 percent coarse sand and 5 to 10 percent gravel.

The C horizon has color of 10YR 5/2, 5/3, 5/4, 6/3, or 6/4. It is loamy coarse sand or coarse sand and is 60 to 70 percent coarse sand. Some pedons have a B2 horizon.

Los Osos Series

The Los Osos series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 5 to 50 percent.

The Los Osos soils are fine, montmorillonitic, thermic Typic Argixerolls.

Typical pedon of a Los Osos loam in an area of Los Osos-Bonnydoon complex, 15 to 30 percent slopes; about 1,200 feet southwest of Lincoln School, on Wilson Road, and 2,700 feet west of intersection of Point Reyes-Petaluma Road and Wilson Road; in Petaluma Road Quadrangle.

A11—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine interstitial and tubular pores; medium acid; gradual wavy boundary.

A12—8 to 18 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; common very fine interstitial and tubular pores; slightly acid; gradual wavy boundary.
B21t—18 to 23 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; slightly acid; clear smooth boundary.
B22t— 23 to 38 inches; brown (10YR 5/3) and yellowish brown (10YR 5/6) clay, grayish brown (10YR 5/2) and brown (10YR 5/3) moist; moderate very fine and fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine interstitial and vesicular pores; many moderately thick clay films on faces of peds and lining pores; neutral; gradual irregular boundary.
Cr—38 inches; highly fractured shale and sandstone.

Bedrock is at a depth of 20 to 40 inches.

The A1 horizon has color of 10YR 4/2 or 5/2. It is 10 to 19 inches thick and is medium acid or neutral. The boundary between the A12 and the B21t horizons is gradual or clear. In some places there is a transitional A3 or B1 horizon.

The Bt horizon has color of 10YR 3/3, 3/4, 3/6, 4/3, 4/4, 4/6, 5/2, 5/3, 5/4, 5/6, or 5/8. It is clay loam or clay and is more than 35 percent clay. The horizon is slightly acid or neutral.

Maymen Series

The Maymen series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 30 to 75 percent.

The Maymen soils are loamy, mixed, mesic Dystric Lithic Xerochrepts.

Typical pedon of a Maymen gravelly loam in an area of Maymen-Maymen Variant gravelly loams, 30 to 75 percent slopes; on Mount Tamalpais; about 1,500 feet northeast on the fire road, from West Point Inn, and 75 feet north of the fire road; in San Rafael Quadrangle.

O1—1 inch to 0; litter and duff.
A1—0 to 5 inches; pale brown (10YR 6/3) gravelly loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure and moderate very fine and fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine interstitial pores; medium acid; clear smooth boundary.
B2—5 to 12 inches; pale brown (10YR 6/3) gravelly loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; common very fine interstitial pores; medium acid; clear wavy boundary.
R—12 inches; hard, highly fractured sandstone.

Bedrock is at a depth of 10 to 20 inches. Base saturation is less than 50 percent throughout the profile.

The A1 horizon has color of 10YR 4/2, 4/3, 5/2, 5/3, 6/3, or 6/4 or of 7.5YR 4/2, 5/2, or 6/4. It is 3 to 6 inches thick. The horizon is 15 to 30 percent gravel and is medium acid to neutral.

The B2 horizon has color of 10YR 6/3 or 6/4 or of 7.5YR 4/4, 5/2, or 6/4. It is 15 to 30 percent gravel and is medium acid or slightly acid.

Maymen Variant

The Maymen Variant consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 30 to 75 percent.

The Maymen Variant soils are clayey, mixed, mesic Typic Haploxerults.

Typical pedon of a Maymen Variant gravelly loam in an area of Maymen-Maymen Variant gravelly loams, 30 to 75 percent slopes, on side slopes of Mount Tamalpais; about 1,800 feet north of fire trail from fire station, on Panoramic Highway; 120 feet down the north side of the fire trail and 1,000 feet east of the water tank along a foot trail; in San Rafael Quadrangle.

O—2 inches to 0; litter and duff.
A1—0 to 4 inches; light brown (7.5YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; strong very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; medium acid; clear smooth boundary.
B21t—4 to 10 inches; light brown (7.5YR 6/4) gravelly clay, dark brown (7.5YR 4/4) moist; moderate very fine and fine subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots and few coarse roots; many very fine and fine interstitial pores and common very fine and fine tubular pores; many thin clay films on faces of peds and lining interstitial pores; medium acid; clear smooth boundary.
B22t—10 to 18 inches; light brown (7.5YR 6/4) and reddish yellow (7.5YR 6/6) gravelly clay, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; many very fine and fine interstitial pores and common very fine

tubular pores; many moderately thick clay films on faces of peds and lining interstitial pores; medium acid; clear smooth boundary.

B23t—18 to 30 inches; strong brown (7.5YR 5/6) gravelly clay, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular pores; common thin clay films on faces of peds and lining interstitial pores; medium acid; gradual smooth boundary.

B24t—30 to 37 inches; reddish yellow (7.5YR 6/8, 7/8) gravelly clay, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; hard, very firm, sticky and plastic; few very fine and fine roots; many very fine and fine interstitial pores and few very fine tubular pores; common thick clay films on faces of peds; medium acid.

R—37 inches; fractured sandstone.

Bedrock is at a depth of 20 to 40 inches.

The A1 horizon has color of 7.5YR 5/4, 5/6, or 6/4. It is 3 to 7 inches thick and is 15 to 35 percent gravel.

The Bt horizon has color of 7.5YR 5/6, 6/4, 6/6, 6/8, or 7/8 or of 5YR 5/6. It is 15 to 30 percent gravel and is medium acid to neutral.

McMullin Series

The McMullin series consists of shallow, well drained soils on uplands. These soils formed in material derived from sandstone. Slope is 15 to 75 percent.

The McMullin soils are loamy, mixed, mesic Lithic Ultic Haploxerolls.

Typical pedon of a McMullin gravelly loam in an area of Tocaloma-McMullin complex, 15 to 30 percent slopes; about 0.6 mile north on San Geronimo-Nicasio Road from the junction of Sir Francis Drake Boulevard and Nicasio Valley-San Geronimo Road, 60 feet east past locked gate on fire road and 48 feet north of fire road; in the San Geronimo area just north at San Geronimo National Golf Course; in San Geronimo Quadrangle.

O—1 inch to 0; duff and litter from bay, oak, and madrone leaves.

A1—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure and moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores and common very fine vesicular and tubular pores; 30 percent pebbles; slightly acid; abrupt smooth boundary.

B2—4 to 18 inches; light yellowish brown (10YR 6/4) gravelly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine interstitial, vesicular, and tubular pores; 30 percent pebbles and few cobbles; medium acid; clear wavy boundary.

R—18 inches; highly fractured sandstone.

Hard, highly fractured sandstone is at a depth of 10 to 20 inches. The profile is 15 to 30 percent gravel throughout. Base saturation is 50 to 75 percent throughout the profile.

The A1 horizon has color of 10YR 4/2, 5/2, or 5/3 or of 7.5YR 4/2 or 5/2. It is 4 to 8 inches thick.

The B2 horizon has color of 10YR 5/2, 6/3, or 6/4.

McMullin Variant

The McMullin Variant consists of shallow, well drained soils on uplands. These soils formed in material derived from conglomerate. Slope is 30 to 50 percent.

The McMullin Variant soils are loamy, mixed, mesic, shallow Typic Xerochrepts.

Typical pedon of a McMullin Variant gravelly sandy clay loam in an area of Bressa Variant-McMullin Variant complex, 30 to 50 percent slopes; 1,300 feet northeast from intersection of Atherson Avenue and Highway 37 and 500 feet west of Highway 37; in Novato Quadrangle.

A1—0 to 4 inches; brown (10YR 5/3) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; common very fine tubular and interstitial pores; 34 percent rounded pebbles 2 to 25 millimeters in diameter; slightly acid; clear wavy boundary.

B2—4 to 14 inches; light yellowish brown (10YR 6/4) gravelly sandy clay loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; common very fine and few fine tubular pores; 23 percent rounded pebbles 2 to 75 millimeters in diameter; few thin clay films as colloidal stains and on peds; strongly acid; abrupt wavy boundary.

Cr—14 inches; weathered conglomerate; matrix can easily be dug with hand tools; roots penetrate in places.

Weathered conglomerate is at a depth of 10 to 20 inches. Base saturation is 75 to 100 percent throughout the profile.

The A1 horizon has color of 10YR 5/2 or 5/3 or of 7.5YR 5/2. It is 2 to 4 inches thick and is 15 to 35 percent gravel.

The B2 horizon has color of 10YR 6/3 or 6/4 or of 7.5YR 6/4. It is gravelly loam or gravelly sandy clay loam

and is 20 to 30 percent clay. The horizon is 15 to 35 percent gravel.

Montara Series

The Montara series consists of shallow, well drained soils on uplands. These soils formed in material derived from serpentinite. Slope is 15 to 30 percent.

The Montara soils are loamy, serpentinitic, thermic Lithic Haploxerolls.

Typical pedon of Montara clay loam, 15 to 30 percent slopes; about 150 feet north of the country club on San Andreas Drive, in the community of San Marin; in Petaluma River Quadrangle.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, black (10YR 2/1) moist; strong fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine interstitial pores; 10 percent pebbles 2 to 20 millimeters in diameter; neutral; gradual smooth boundary.

A12—5 to 13 inches; very dark grayish brown (10YR 3/2) clay loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common very fine interstitial pores; 15 percent pebbles 2 to 25 millimeters in diameter; moderately alkaline; abrupt wavy boundary.

R—13 inches; hard, fractured serpentinite.

Bedrock commonly is at a depth of 10 to 15 inches, but its depth ranges to 20 inches. The profile is 0 to 15 percent gravel throughout. About 5 percent of the surface is covered with stones.

The A1 horizon has color of 10YR 2/1, 3/2, or 4/2. It is neutral to moderately alkaline.

Novato Series

The Novato series consists of very deep, very poorly drained soils along the margins of bays in tidal marshes. These soils formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

The Novato soils are fine, mixed, nonacid, isomesic Typic Hydraquents.

Typical pedon of Novato clay, about 1 mile east of Gnoss Airport runway; about 1,300 feet northwest of KCBS radio station, and 200 feet north of levee, in Petaluma Quadrangle.

A11g—0 to 2 inches; light gray (5Y 7/1) clay, very dark grayish brown (2.5Y 3/2) moist; common medium distinct mottles that are dark brown (7.5YR 4/4) when moist; massive; extremely hard, firm, sticky and plastic; many very fine and coarse roots; many fine tubular pores; moderately alkaline; abrupt smooth boundary.

A12g—2 to 6 inches; light gray (5Y 7/1) clay, dark olive gray (5Y 3/2) moist; common medium distinct mottles that are dark reddish brown (5YR 3/4) when moist; massive; extremely hard, firm, sticky and plastic; common very fine and fine roots; common fine tubular pores; moderately alkaline; clear smooth boundary.

A13g—6 to 15 inches; gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; common medium distinct mottles that are reddish brown (5YR 4/4) when moist; massive; extremely hard, firm, sticky and plastic; common very fine and fine roots; few fine and medium tubular pores; moderately alkaline; gradual smooth boundary.

C1g—15 to 27 inches; gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; common medium distinct jarosite mottles that are reddish brown (5YR 4/4) and pale yellow (2.5Y 7/4) when moist and are in lower part of horizon; massive; extremely hard, firm, sticky and plastic; few very fine roots; few fine tubular pores; moderately alkaline; gradual smooth boundary.

C2g—27 to 40 inches; gray and light gray (5Y 6/1, 7/1) clay, dark gray (5Y 4/1) moist; common medium distinct jarosite mottles that are pale yellow (2.5Y 8/4) when moist; massive; extremely hard, firm, sticky and plastic; few very fine roots; common coarse tubular pores; moderately alkaline; gradual smooth boundary.

C3g—40 to 60 inches; light gray (N 6/0) clay, very dark gray (N 3/0) moist; massive; extremely hard, firm, sticky and plastic; few very fine roots; few very fine and common coarse tubular pores; moderately alkaline.

The content of organic matter in the profile decreases irregularly with increasing depth. The *n* value is 1.0 to 1.5. Sulfidic material is between depths of 20 and 40 inches. The solum is 8 to 20 inches thick.

The A11 horizon has color of 2.5Y 5/2, 6/2, or 7/2 or of 10YR or 5Y 4/2, 5/2, 5/3, 6/1, 6/2, 6/3, 7/1, or 7/2. It is 2 to 5 inches thick and is moderately alkaline or strongly alkaline.

The C horizon has color of N 5/0 or 6/0, of 5Y 6/1, 6/2, or 7/1, of 2.5Y 6/2, or of 10YR 6/1 or 6/2. It has few to common, fine and medium, distinct mottles that have color of 10YR 4/4 or 4/6, of 2.5Y 7/4 or 8/4, of 7.5YR 3/4, 4/4, or 4/6, or of 5YR 3/4 or 4/4. The horizon is silty clay loam, silty clay, or clay and is moderately alkaline or strongly alkaline. Thin strata of organic material or clam shells are in some pedons.

Olompali Series

The Olompali series consists of deep, somewhat poorly drained soils on coastal terraces. These soils formed in alluvium derived from various kinds of rock. Slope is 2 to 30 percent.

The Olompali soils are fine, montmorillonitic, mesic Ultic Palexeralfs.

Typical pedon of Olompali loam, 9 to 15 percent slopes; about 4,500 feet north on Highway 1 from turnoff to Cypress Grove, along Tomales Bay, and 100 feet west of U.S. Highway 1; in Tomales Quadrangle.

A11—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure parting to moderate coarse granular; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial and vesicular pores and common very fine tubular pores; medium acid; clear wavy boundary.

A12—8 to 13 inches; mixed pale brown and grayish brown (10YR 6/3, 5/2) loam, mixed very dark grayish brown and dark brown (10YR 3/2, 4/3) moist; moderate fine subangular blocky structure parting to weak medium granular; slightly hard, very friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial and vesicular pores and common very fine tubular pores; slightly acid; abrupt wavy boundary.

B21t—13 to 19 inches; yellowish brown (10YR 5/6) clay, yellowish brown (10YR 5/4) moist; common large distinct light yellowish brown (10YR 6/4) mottles, strong brown (7.5YR 5/8) moist; moderate medium prismatic structure; hard, very firm, very sticky and very plastic; common very fine roots; few very fine interstitial pores; many moderately thick clay films lining pores; neutral; abrupt wavy boundary.

B22t—19 to 28 inches; mixed brown and yellowish brown (10YR 5/3, 5/4) clay, light olive brown (2.5Y 5/4) moist; many medium prominent yellowish brown (10YR 5/8) mottles, strong brown (7.5YR 5/8) moist; moderate medium subangular blocky structure; hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial pores; many moderately thick clay films lining pores; many large irregularly shaped manganese concretions; neutral; gradual wavy boundary.

B23t—28 to 42 inches; mixed pale brown, light yellowish brown, and brownish yellow (10YR 6/3, 6/4, 6/6) gravelly clay, light olive brown (2.5Y 5/4) moist; large prominent mottles that are yellowish brown (10YR 5/8) when moist; weak fine and medium subangular blocky structure; hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial pores; many moderately thick clay films lining pores; common medium irregularly shaped manganese concretions; neutral; abrupt wavy boundary.

B24t—42 to 60 inches; mixed pale brown, light yellowish brown, and brownish yellow (10YR 6/3, 6/4, 6/6) clay, light olive brown (2.5Y 5/4) moist; many large prominent yellowish brown (10YR 5/6) mottles, strong brown (7.5YR 5/8) moist; massive; hard, very firm, sticky and plastic; few very fine roots; few very fine interstitial pores; continuous thick clay films lining pores; common medium irregularly shaped manganese concretions; neutral.

Base saturation is less than 50 percent in the A11 horizon and is less than 75 percent in some parts of the Bt horizon. The solum is 40 to 60 inches thick or more.

The A1 horizon has color of 10YR 4/2, 5/2, 5/3, or 6/3. It is 10 to 20 inches thick and is slightly acid or medium acid.

The Bt horizon has color of 10YR 5/2, 5/3, 5/4, 5/6, 6/3, 6/4, or 6/6. It is medium acid to neutral. The horizon is 15 to 30 percent gravel in a few pedons.

Pablo Series

The Pablo series consists of shallow, well drained soils on uplands. These soils formed in material derived from siliceous shale and sandstone. Slope is 15 to 75 percent.

The Pablo soils are loamy, mixed, isomesic Lithic Haplustolls.

Typical pedon of a Pablo loam in an area of Pablo-Bayview complex, 50 to 75 percent slopes, in the Point Reyes National Seashore, about 0.7 mile west on Limantour Road from Bayview Trailhead and about 75 feet north of Limantour Road; in Inverness Quadrangle.

A11—0 to 3 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate very fine granular structure and weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and few coarse roots; many very fine tubular and interstitial pores; slightly acid; clear smooth boundary.

A12—3 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; many very fine tubular and interstitial pores; medium acid; gradual smooth boundary.

A13—6 to 15 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; many very fine tubular and interstitial pores; medium acid; abrupt irregular boundary.

R—15 inches; hard, highly fractured siliceous shale.

Hard, fractured siliceous shale is at a depth of 10 to 20 inches. The difference between the mean winter soil temperature and the mean summer soil temperature is 7 to 9 degrees F. Angular rock fragments, mostly gravel,

make up as much as 15 percent of the profile. The profile is medium acid or slightly acid, decreasing in acidity with increasing depth.

The A11 horizon has color of 10YR 4/1, 4/2, 5/1, or 5/2. It is 2 to 5 inches thick.

Some pedons have a thin B2 or C horizon between the lower part of the A horizon and the bedrock.

Palomarin Series

The Palomarin series consists of deep, well drained soils on uplands. These soils formed in material derived from siliceous shale and sandstone. Slope is 9 to 75 percent.

The Palomarin soils are fine-loamy, mixed, isomesic Typic Dystropepts.

Typical pedon of a Palomarin loam, in an area of Palomarin-Wittenberg complex, 9 to 15 percent slopes, in the Point Reyes National Seashore; about 3.7 miles west on Stewarts Trail, from Five Brooks Trailhead, and 50 feet east of Stewarts Trail; in Double Point Quadrangle.

O1—2 inches to 0; litter and duff, mostly Douglas-fir needles.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular and interstitial pores; very strongly acid; clear smooth boundary.

A12—3 to 18 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; very strongly acid; diffuse smooth boundary.

A13—18 to 29 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; very strongly acid; clear irregular boundary.

C—29 to 41 inches; brown (10YR 5/3) loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine pores; very strongly acid; clear irregular boundary.

R—41 inches; hard, highly fractured siliceous shale; fractures more than 1 inch across and less than 4 inches apart.

Hard, fractured, angular siliceous shale is at a depth of 40 to 60 inches or more. The difference between the mean summer soil temperature and the mean winter soil temperature is 6 to 9 degrees F. The solum is 20 to 35 inches thick. The profile is very strongly acid or strongly acid throughout. Base saturation is less than 50 percent throughout the profile.

The A1 horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 3/2, 4/2, or 5/2. It is 0 to 10 percent gravel.

The C horizon has color of 10YR 5/3, 5/4, 6/3, or 6/4 or of 7.5YR 5/4, 5/6, 6/4, or 6/6. It is loam or gravelly loam. The horizon is 10 to 25 percent gravel. The lower part of the horizon is 5 to 20 percent cobbles in some pedons.

Reyes Series

The Reyes series consists of very deep, somewhat poorly drained soils that formed in alluvium deposited along the margin of bays. These soils are in areas of reclaimed tidelands. Slope is 0 to 2 percent.

The Reyes soils are fine, mixed, acid, thermic Sulfic Fluvaquents.

Typical pedon of Reyes clay, about 4,400 feet north of Burdell Island on Redwood Sanitary Landfill property and 100 feet west of levee; in Petaluma River Quadrangle.

Ap1—0 to 7 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine granular structure and moderate fine and medium subangular blocky; hard, firm, sticky and plastic; many very fine roots; common very fine and fine tubular and interstitial pores; very strongly acid; clear smooth boundary.

A12—7 to 14 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; few small faint dark yellowish brown (10YR 4/4) mottles, dark yellowish brown (10YR 3/4) moist; moderate fine and medium angular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine and fine tubular and interstitial pores; very strongly acid; clear wavy boundary.

C21g—14 to 22 inches; gray (5Y 6/1) clay, dark olive gray (5Y 3/2) moist; common medium prominent brown and strong brown (7.5YR 5/4, 5/6) mottles, reddish brown and yellowish red (5YR 4/4, 4/6) moist, and common white and pale yellow (2.5Y 8/2, 8/4) mottles, pale yellow and yellow (2.5Y 7/4, 7/6) moist; strong medium and coarse angular blocky structure; very hard, firm, sticky and plastic; many very fine roots; common medium and coarse tubular and interstitial pores; very strongly acid; clear wavy boundary.

C2g—22 to 41 inches; gray (5Y 6/1) silty clay, dark olive gray (5Y 3/2) moist; many medium and large prominent strong brown and light brown (7.5YR 5/6,

6/4) mottles, reddish brown and yellowish red (5YR 4/4, 4/6) moist, and common white (5Y 8/1, 8/2) sulfidic mottles, pale yellow and yellow (2.5Y 7/4, 7/6) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; many very fine roots; common medium and coarse tubular and interstitial pores; extremely acid; gradual irregular boundary.

C3g—41 to 51 inches; gray (N 6/0) silty clay, black (5Y 2/2) moist; few small prominent yellowish brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) moist, and common light brownish gray (2.5Y 6/2) sulfidic mottles, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular and interstitial pores; extremely acid; clear wavy boundary.

C4g—51 to 71 inches; gray (N 6/0) silty clay loam, black (5Y 2/2) moist; massive; hard, firm, sticky and plastic; few very fine roots; common very fine tubular and interstitial pores; a layer of peaty material 1 inch to 1.5 inches thick is in middle of horizon; strong hydrogen sulfide odor is present in lower part of horizon; white crystals of salt appear upon drying; mildly alkaline.

The content of organic matter in the profile decreases irregularly with increasing depth. The *n* value is 0.3 to 0.7. A water table is at a depth of 53 to 68 inches. The solum is 15 to 45 inches thick. Sulfidic mottles are at a depth between 20 and 40 inches.

The A horizon has color of 2.5Y 5/2, 6/2, or 7/2 or of 10YR 5/2, 5/3, 6/2, 6/3, or 7/2. The lower part of the horizon has few to common, fine or medium, faint, distinct, or prominent mottles that have color of 10YR 4/4 or 4/6, of 7.5YR 3/4, 4/4, 4/6, or 5/6, or of 5YR 3/4, 4/3, 4/4, or 4/6. The A horizon is 5 to 18 inches thick and is very strongly acid to slightly acid.

The C horizon has color of 5Y 6/1 or 6/2, of 2.5Y 6/2, or of 10YR 6/1 or 6/2. It has few to common, fine or medium, distinct or prominent mottles that have color of 10YR 4/4 or 4/6, of 7.5YR 3/4, 4/4, 5/4, 5/6, or 6/4, or of 5YR 3/4. The horizon is silty clay loam, clay, silty clay, or clay. It is more than 35 percent clay and is very strongly acid to mildly alkaline.

Rodeo Series

The Rodeo series consists of very deep, poorly drained soils in narrow valleys and basins. These soils formed in mixed alluvium derived from chert, sandstone, and granite. Slope is 2 to 15 percent.

The Rodeo soils are fine, montmorillonitic, isomesic Aquic Paleustolls.

Typical pedon of Rodeo clay loam, 2 to 15 percent slopes, in the Golden Gate National Recreational area; about 1,400 feet north of old dairy barn and 700 feet east of light duty road at Fort Barry; in Point Bonita Quadrangle.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; hard, very friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular pores; medium acid; clear smooth boundary.

A12—6 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, very friable, sticky and plastic; many very fine and fine roots; many very fine interstitial and tubular pores; medium acid; clear wavy boundary.

A2—14 to 20 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common medium faint mottles that are brownish yellow (10YR 6/8) when moist, and common medium distinct mottles that are brownish yellow and yellowish brown (10YR 6/8, 5/8) when moist; massive; very friable, sticky and plastic; common very fine roots; many very fine interstitial and tubular pores; few fine concretions, generally rounded; medium acid; abrupt smooth boundary.

B21t—20 to 29 inches; mixed pale brown, light yellowish brown, and brownish yellow (10YR 6/3, 6/4, 6/8) clay, yellowish brown (10YR 5/4) moist; many medium and large prominent mottles that are yellowish red (5YR 4/8) when moist; medium fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores and few very fine interstitial pores; many moderately thick clay films lining pores and on faces of peds; common fine concretions, generally rounded; medium acid; clear wavy boundary.

B22t—29 to 40 inches; mixed pale brown and brownish yellow (10YR 6/3, 6/8) clay, strong brown and yellowish red (7.5YR 5/8, 5YR 5/8) moist; many medium prominent mottles that are gray and light gray (5Y 5/1, 6/1) when moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine interstitial pores; many moderately thick clay films lining pores and on faces of peds; common fine concretions, generally rounded; very strongly acid; gradual wavy boundary.

B23t—40 to 58 inches; mixed light gray, brownish yellow, and yellowish brown (10YR 7/2, 6/6, 5/8) clay, yellowish brown and pale brown (10YR 5/6, 6/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine pores; many moderately thick clay films lining pores and on faces of peds; common fine concretions, generally rounded; very strongly acid; clear wavy boundary.

B24t—58 to 75 inches; mixed light gray and brownish yellow (10YR 7/2, 6/8) clay, mixed pale brown and brown (10YR 6/3, 7.5YR 4/4) moist; massive; hard, very firm, sticky and plastic; few very fine roots; common thin clay films lining pores; few fine concretions, generally rounded; very strongly acid.

The difference between the mean winter soil temperature and the mean summer soil temperature is less than 9 degrees F. The profile is medium acid to very strongly acid, increasing in acidity with increasing depth. The control section averages 35 to 50 percent clay. The solum is 40 to 60 inches thick or more.

The A horizon has color of 10YR 3/1, 3/2, 4/1, or 4/2. It is 9 to 20 inches thick.

The A2 horizon has color of 10YR 6/3 or 7/3, and it commonly has mottles that have color of 10YR 5/4, 5/6, 6/6, or 6/8.

The B2t horizon has color of 10YR 5/8, 6/3, 6/4, 6/6, 6/8, 7/2, or 7/3, and it commonly has mottles that have color of 5YR 4/8 or 5Y 5/1 or 6/1 when moist. The horizon is clay or clay loam and is 35 to 50 percent clay. It is 2 to 15 percent rounded concretions throughout.

Saurin Series

The Saurin series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 2 to 75 percent.

The Saurin soils are fine-loamy, mixed, thermic Typic Haploxerolls.

Typical pedon of a Saurin clay loam in an area of Saurin-Bonnydoon complex, 50 to 75 percent slopes, in the San Geronimo area; about 2,700 feet west of White Hill and 1,700 feet south of water tank; in Bolinas Quadrangle.

A11—0 to 10 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 3/3) moist; strong very fine, fine, and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine interstitial and tubular pores; 5 percent pebbles; slightly acid; clear smooth boundary.

A12—10 to 22 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 3/3) moist; moderate very fine, fine, and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine interstitial and tubular pores; 5 percent pebbles; slightly acid; clear wavy boundary.

B2t—22 to 33 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial and tubular pores; few thin clay films on faces of peds and lining pores; 5 percent pebbles; slightly acid; clear wavy boundary.

Cr—33 inches; highly weathered, highly fractured sandstone.

Bedrock is at a depth of 20 to 40 inches.

The A1 horizon has color of 10YR 5/2, 5/3, or 5/4. It is 15 to 25 inches thick. The content of organic matter is more than 1 percent to a depth of 20 inches. The horizon is medium acid to neutral.

The B2t horizon has color of 10YR 4/2, 5/2, or 5/4. The horizon is medium acid to neutral.

The Saurin soils in this survey area that are on Bolinas Ridge and are in map units 162, 163, and 164 are taxadjuncts to the Saurin series because they have a mollic epipedon that is more than 20 inches thick. This difference, however, does not significantly affect use and management.

Sheridan Variant

The Sheridan Variant consists of moderately deep, well drained soils on coastal uplands. These soils formed in material derived from quartz-diorite. Slope is 9 to 75 percent.

The Sheridan Variant soils are coarse-loamy, mixed, isomesic Ustic Dystropepts.

Typical pedon of Sheridan Variant coarse sandy loam, 30 to 50 percent slopes, in Tomales Bay State Park; about 1,700 feet east by Pierce Point Road, from entrance to Tomales Bay State Park and Pierce Point Road; 600 feet east from Pierce Point Road on private paved road and 150 feet north of private paved road; in Drakes Bay Quadrangle.

O1—2 inches to 0; partially decomposed bishop pine needles and twigs.

A11—0 to 16 inches; brown (7.5YR 4/4) coarse sandy loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores and common medium vesicular pores; medium acid; gradual wavy boundary.

A12—16 to 26 inches; brown and dark brown (7.5YR 5/4, 4/4) coarse sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure and weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores and common medium vesicular pores; slightly acid; gradual wavy boundary.

C1—26 to 31 inches; strong brown (7.5YR 5/6) coarse sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure and

weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular and interstitial pores and few fine vesicular pores; 5 percent pebbles 2 to 25 millimeters in diameter; medium acid; gradual irregular boundary.

C2r—31 inches; soft, weathered quartz-diorite.

Soft, weathered quartz-diorite is at a depth of 20 to 40 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is 7 to 9 degrees F. The profile is 25 to 35 percent coarse sand and is less than 18 percent clay throughout. Base saturation is 14 to 27 percent, increasing with depth. The solum is 15 to 30 inches thick.

The A11 horizon has color of 7.5YR 4/4, 5/4, or 5/6. It is 8 to 20 inches thick. The horizon is 5 to 15 percent gravel.

The C horizon has color of 7.5YR 5/6, 6/4, or 6/6. It is coarse sandy loam or gravelly sandy loam. The horizon is 5 to 20 percent gravel.

Sirdrak Series

The Sirdrak series consists of very deep, somewhat excessively drained, sandy soils in rolling dunelike areas. These soils formed in windblown deposits from coastal beaches. Slope is 2 to 50 percent.

The Sirdrak soils are sandy, mixed, isomesic Ustic Dystropepts.

Typical pedon of Sirdrak sand, 2 to 15 percent slopes; about 500 feet southeast on dirt road, from intersection of Pierce Point Road and the north entrance to McClure Ranch, in the Point Reyes National Seashore, and about 100 feet west of dirt road; in Tomales Quadrangle.

A11—0 to 16 inches; very dark grayish brown (10YR 3/2) sand, very dark brown (10YR 2/2) moist; single grained; loose, very friable, nonsticky and nonplastic; many very fine roots, common fine roots, and few coarse roots; many very fine interstitial pores; medium acid; clear smooth boundary.

A12—16 to 36 inches; very dark grayish brown (10YR 3/2) sand, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots and common medium roots; many very fine interstitial pores; slightly acid; clear smooth boundary.

AC—36 to 48 inches; dark yellowish brown (10YR 4/4) sand, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots and common medium roots; many very fine interstitial pores; slightly acid; clear wavy boundary.

C1—48 to 62 inches; yellowish brown (10YR 5/4) sand, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots and common medium roots; many very fine interstitial pores; slightly acid; abrupt smooth boundary.

C2—62 to 73 inches; light yellowish brown (10YR 6/4) sand, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots and common medium roots; many very fine interstitial pores; slightly acid.

The difference between the mean summer soil temperature and the mean winter soil temperature is 7 to 9 degrees F. The profile is 75 to 95 percent sand throughout. The content of organic matter is 1 to 5 percent to a depth of 20 inches. Base saturation is less than 50 percent in some parts of the C horizon.

The A horizon is 40 to 60 inches thick or more. It has color of 10YR 3/2, 3/3, 4/1, 4/2, or 4/4. The horizon is medium acid or slightly acid.

The C horizon has color of 10YR 4/4, 5/4, 5/6, 6/3, or 6/4. It is sand or loamy sand and is slightly acid or medium acid.

Sirdrak Variant

The Sirdrak Variant consists of deep, somewhat poorly drained soils in dunelike areas. These soils formed in sandy windblown deposits from nearby beaches. Slope is 0 to 5 percent.

The Sirdrak Variant soils are sandy, mixed, isomesic Aquic Dystropepts.

Typical pedon of Sirdrak Variant sand, 0 to 5 percent slopes; about 1,000 feet northwest on road to RCA Earth Satellite Receiving station, from Sir Francis Drake Boulevard, and 200 feet east from road to RCA Earth Satellite Receiving station; in the Point Reyes National Seashore; in Drakes Bay Quadrangle.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, loose, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; medium acid; clear wavy boundary.

A12—5 to 28 inches; very dark grayish brown (10YR 3/2) sand, very dark brown (10YR 2/2) moist; massive; soft, loose, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine interstitial pores; medium acid; gradual wavy boundary.

A13—28 to 38 inches; mixed very dark grayish brown (10YR 3/2) and brown (7.5YR 5/2) sand, mixed very dark brown (10YR 2/2) and dark brown (7.5YR 3/2) moist; massive; soft, loose, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; slightly acid; gradual irregular boundary.

B2ir—38 to 59 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; many large

prominent strong brown (7.5YR 5/6), reddish brown (5YR 4/3), and dark reddish brown (5YR 4/4) mottles; massive; soft, loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 25 to 30 percent red or dark red (2.5YR 4/6, 3/6) concretions 1/2 inch to 8 inches across in irregular pockets; neutral; gradual irregular boundary.

C2—59 to 72 inches; light gray (2.5Y 7/2) sand, grayish brown (2.5Y 5/2) moist; many medium yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) mottles; massive; soft, loose, nonsticky and nonplastic; many very fine interstitial pores; few small soft iron concretions; slightly acid.

Base saturation is 20 to 50 percent throughout the profile. The profile is 75 to 95 percent sand throughout. A water table is at a depth of 2 to 3 feet during the rainy season and at a depth of 4 to 6 feet during the dry season.

The A horizon is 20 to 40 inches thick. The Ap horizon has color of 10YR 3/1, 3/2, 4/1, or 4/2. It is 5 to 10 inches thick. The horizon is slightly acid to strongly acid.

The B2ir horizon is at a depth of 35 to 50 inches. It has intermittent iron concretions that form an irregular, discontinuous hardpan 10 to 25 inches thick. Most of the concretions are very hard when dry, but some are slightly hard. Some of the smaller concretions can be crushed with the fingers, but most of the larger ones are difficult to break with the hands. Color of the Bir horizon is mainly 10YR 6/4, but it is 7.5YR 5/6 or 5YR 4/3 or 4/4 in some pedons. The horizon is neutral to medium acid.

The C2 horizon has color of 2.5YR 6/2 or 7/2. It is strongly acid to slightly acid.

Sobega Series

The Sobega series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from coarse-grained sandstone. Slope is 9 to 30 percent.

The Sobega soils are fine-loamy, mixed, mesic Udic Ustochrepts.

Typical pedon of Sobega loam, 9 to 15 percent slopes; about 1,000 feet north on road to entrance to Tomales High School, from Tomales-Petaluma Road, and 400 feet west of road to entrance to Tomales High School; in Tomales Quadrangle.

A11—0 to 10 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine, fine, and medium irregular and tubular pores; strongly acid; clear wavy boundary.

A12—10 to 17 inches; mixed brown (10YR 5/3) and pale brown (10YR 6/3) loam, mixed very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine irregular and tubular pores; medium acid; clear wavy boundary.

B2t—17 to 22 inches; mixed yellow (10YR 7/6) and very pale brown (10YR 8/4) loam, mixed yellowish brown (10YR 5/4) and dark brown (10YR 3/3) moist; weak medium granular structure; hard, very friable, slightly sticky and slightly plastic; few very fine and fine irregular pores; medium acid; gradual irregular boundary.

Cr—22 inches; yellow and very pale brown (10YR 8/6, 8/4) soft, highly weathered sandstone; thick clay films in seams; medium acid.

Bedrock is at a depth of 20 to 40 inches. In some areas the profile is as much as 5 to 15 percent fine gravel throughout. Base saturation is less than 50 percent throughout the profile, but it commonly increases slightly with depth. The content of organic matter is 1 percent or more to a depth of 20 inches or less. The control section averages 18 to 27 percent clay.

The A horizon has color of 10YR 5/2 or 5/3. It is 10 to 25 inches thick. The horizon is very strongly acid to medium acid.

The Bt horizon has color of 10YR 7/3, 7/4, 7/6, 7/8, or 8/4. It is loam or sandy loam. The horizon is strongly acid to slightly acid. Some pedons have a transitional B3 horizon that has thick clay films extending into seams in the C horizon.

The Sobega soils in this survey area that are on Point Reyes and are in map units 195 and 196 are taxadjunct to the Sobega series because they have a difference of less than 9 degrees F between the mean summer soil temperature and the mean winter soil temperature. This difference, however, does not significantly affect use and management.

Soulajule Series

The Soulajule series consists of moderately deep, well drained soils on coastal uplands. These soils formed in material derived from sandstone and shale. Slope is 9 to 75 percent.

The Soulajule soils are clayey-skeletal, mixed, mesic Ultic Haploxeralfs.

Typical pedon of a Soulajule clay loam in an area of Felton Variant-Soulajule complex, 9 to 15 percent slopes; about 4,500 feet south of Marconi on Highway 1, along Tomales Bay, and 1,700 feet east of Highway 1; in Point Reyes N.E. Quadrangle.

Ap—0 to 7 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable, sticky and

plastic; many very fine and fine roots; many very fine and fine interstitial pores; 2 to 5 percent gravel; strongly acid; clear wavy boundary.

A12—7 to 17 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium granular structure; slightly hard, very friable, sticky and plastic; common very fine and fine roots; many very fine and fine interstitial and vesicular pores; 2 to 5 percent gravel; medium acid; clear irregular boundary.

B21t—17 to 22 inches; reddish brown (5YR 5/4) gravelly clay, mixed reddish brown and yellowish red (5YR 4/4, 4/6) moist; weak fine and medium subangular blocky structure parting to weak medium granular; hard, firm, very sticky and very plastic; common very fine and fine roots; many very fine interstitial and vesicular pores; common thin clay films lining pores and on faces of peds; 20 percent gravel; slightly acid; clear irregular boundary.

B22t—22 to 28 inches; yellowish red (5YR 5/6) very gravelly clay, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine interstitial pores; common thin clay films lining pores and on faces of peds; 50 percent gravel; slightly acid; gradual irregular boundary.

Cr—28 inches; highly weathered sandstone; clay in fracture planes.

Bedrock is at a depth of 20 to 40 inches. Base saturation is less than 50 percent throughout the profile. The control section averages 35 to 50 percent clay.

The A horizon, when moist, has chroma of more than 3.5 throughout. The Ap horizon has color of 7.5YR 4/4, 5/4, or 5/6 or of 5YR 5/4 or 5/6. It is 5 to 9 inches thick and averages 0 to 10 percent gravel. The horizon is strongly acid to slightly acid.

The Bt horizon has color of 7.5YR 5/4 or 6/6 or of 5YR 5/4, 5/6, or 7/8. It is gravelly clay loam, very gravelly clay loam, or very gravelly clay and averages 25 to 60 percent gravel. The horizon is strongly acid to slightly acid.

Steinbeck Series

The Steinbeck series consists of deep, well drained soils on uplands. These soils formed in material derived from soft sandstone. Slope is 5 to 50 percent.

The Steinbeck soils are fine-loamy, mixed, mesic Ultic Haplustalfs.

Typical pedon of a Steinbeck loam in an area of Tomales-Steinbeck loams, 5 to 15 percent slopes; about 3,600 feet northwest of U.S. Highway 1, from the intersection of Dillon Road, and 0.5 mile west of U.S. Highway 1; in Valley Ford Quadrangle.

A11—0 to 12 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to moderate medium granular; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and vesicular pores; medium acid; gradual wavy boundary.

A12—12 to 23 inches; grayish brown (10YR 5/2) loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak medium granular; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine interstitial and vesicular pores and common fine tubular pores; slightly acid; clear wavy boundary.

A2—23 to 35 inches; mixed very pale brown and pale brown (10YR 7/4, 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; slightly acid; abrupt wavy boundary.

B21t—35 to 42 inches; mixed grayish brown and light yellowish brown (10YR 5/2, 6/4) clay loam, yellowish brown (10YR 5/4) moist; common medium prominent yellowish red (5YR 5/8) and dark grayish brown (10YR 4/2) mottles; massive; slightly hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores and few very fine tubular pores; few thin clay films lining pores; slightly acid; gradual wavy boundary.

B22t—42 to 48 inches; mixed light yellowish brown and brownish yellow (10YR 6/4, 6/8) clay loam, yellowish brown (10YR 5/6, 5/4) moist; common medium prominent dark yellowish brown (10YR 3/6) and brownish yellow (10YR 6/8) mottles; massive; hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; few thin dark yellowish brown (10YR 3/6) clay films lining pores; slightly acid; gradual irregular boundary.

Cr—48 inches; highly weathered sandstone; massive; medium acid.

Soft, highly weathered sandstone is at a depth of 40 to 60 inches or more. The content of organic matter is 1 percent or more to a depth of 20 inches.

Base saturation of the A horizon is less than 50 percent. The A1 horizon has color of 10YR 4/1, 4/2, 5/1, or 5/2. It is 10 to 25 inches thick and is medium acid or slightly acid. The A2 horizon has color of 10YR 6/3, 7/2, 7/3, or 7/4. It is loam or fine sandy loam and is medium acid or slightly acid.

The Bt horizon has color of 10YR 5/2, 6/4, or 6/8. It is clay loam or loam. The Bt horizon is strongly acid to slightly acid.

The Steinbeck soils in this survey area that are on Point Reyes and are in map unit 197 are taxadjunct to the Steinbeck series because they have a difference of

less than 9 degrees F between the mean summer soil temperature and the mean winter soil temperature. This difference, however, does not significantly affect use and management.

Tamalpais Series

The Tamalpais series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from chert and sandstone. Slope is 15 to 75 percent.

The Tamalpais soils are loamy-skeletal, mixed, isomesic Typic Argiustolls.

Typical pedon of Tamalpais-Barnabe Variant very gravelly loams, 30 to 50 percent slopes; about 1,500 feet north of quarry on Bunker Road and 500 feet west of dirt road in Marin Headlands, Golden Gate National Recreation area; in Point Bonita Quadrangle (inset to Double Point Quadrangle).

A11—0 to 10 inches; dark brown (7.5YR 4/4) very gravelly loam, dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 35 percent pebbles 2 to 74 millimeters in diameter; medium acid; gradual wavy boundary.

A12—10 to 19 inches; dark brown (7.5YR 4/4) very gravelly loam, dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; few medium tubular pores and many very fine and fine tubular and interstitial pores; 40 percent pebbles 2 to 74 millimeters in diameter; slightly acid; gradual wavy boundary.

B1t—19 to 28 inches; brown (7.5YR 5/4) very gravelly clay loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on faces of peds, lining pores, and bridging mineral grains; 45 percent pebbles 2 to 74 millimeters in diameter; slightly acid; gradual smooth boundary.

B2t—28 to 39 inches; dark reddish brown (5YR 3/4) very gravelly clay loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; hard, friable, very sticky and very plastic; few very fine roots; many very fine and fine tubular and interstitial pores; many moderately thick clay films on faces of peds, lining pores, and bridging mineral grains; 40 percent pebbles 2 to 74 millimeters in diameter; neutral; abrupt irregular boundary.

R—39 inches; hard, fractured radiolarian chert and sandstone.

Hard bedrock is at a depth of 20 to 40 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is 7 to 9 degrees F. The profile averages 35 to 50 percent angular and subangular fragments of chert and sandstone throughout. The control section is 27 to 35 percent clay.

The A1 horizon has color of 5YR 3/4, 4/3, 4/4, or 5/4 or of 7.5YR 3/2, 4/2, 4/4, 5/2, or 5/4. It is 12 to 20 inches thick and is medium acid or slightly acid.

The Bt horizon has color of 7.5YR 4/4 or 5/4 or of 5YR 3/3, 3/4, 4/3, 4/4, or 5/4. It is very gravelly clay loam or very gravelly clay and is medium acid to neutral.

Tocaloma Series

The Tocaloma series consists of moderately deep, well drained soils on uplands. These soils formed in material derived from sandstone and shale. Slope is 15 to 75 percent.

The Tocaloma soils are fine-loamy, mixed, mesic Typic Haploxerolls.

Typical pedon of Tocaloma loam in an area of Tocaloma-Saurin association, very steep, about 3,500 feet north on Marshall-Petaluma Road, from Wilson Road, and 1,100 feet east of Marshall-Petaluma Road; in Petaluma quadrangle.

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and few very fine tubular pores; slightly acid; clear smooth boundary.

A12—4 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and common very fine tubular pores; slightly acid; clear smooth boundary.

A13—9 to 15 inches; brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine interstitial pores and few very fine vesicular and tubular pores; medium acid; clear smooth boundary.

A14—15 to 19 inches; brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine interstitial pores and common very fine vesicular and tubular pores; medium acid; clear smooth boundary.

B2—19 to 39 inches; light yellowish brown (10YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine interstitial pores and few very fine tubular pores; 40 percent pebbles; medium acid; gradual irregular boundary.
Cr—39 inches; highly weathered, highly fractured sandstone.

Bedrock is at a depth of 20 to 40 inches. The control section averages less than 35 percent gravel.

The A1 horizon has color of 10YR 5/2 or 5/3. It is 12 to 19 inches thick.

The B2 horizon has color of 10YR 6/3 or 6/4 or of 7.5YR 4/4. It is 35 to 50 percent gravel.

Tomales Series

The Tomales series consists of deep, moderately well drained soils on coastal uplands. These soils formed in material derived from soft sandstone. Slope is 2 to 50 percent.

The Tomales soils are fine, mixed, mesic Ultic Paleustalfs.

Typical pedon of Tomales loam, 9 to 15 percent slopes, southwest of the town of Valley Ford; about 1.1 miles southwest on Estero Road, from the intersection of Valley Ford-Franklin School Road, and 300 feet north of Estero Road; in Valley Ford Quadrangle.

A11—0 to 3 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; strong medium and coarse granular structure; hard, very friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; few very fine tubular pores and many very fine interstitial pores; medium acid; clear smooth boundary.
A12—3 to 8 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; many very fine and fine tubular pores and many very fine interstitial pores; strongly acid; gradual smooth boundary.
A13—8 to 12 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores and many very fine interstitial pores; strongly acid; clear wavy boundary.
A21—12 to 19 inches; mixed pale brown (10YR 6/3) and grayish brown (10YR 5/2) loam, mixed brown (10YR 4/3) and very dark grayish brown (10YR 3/2) moist; weak coarse angular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; many very fine and fine tubular and interstitial pores; strongly acid; gradual irregular boundary.
A22—19 to 24 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; few fine faint mottles that are grayish brown (10YR 5/2) when moist and few medium prominent mottles that are reddish brown (5YR 4/3) when moist; weak coarse angular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; many very fine, fine, and medium tubular and interstitial pores; few thin clay films in pores; strongly acid; abrupt irregular boundary.
B2t—24 to 34 inches; mixed light brownish gray (2.5Y 6/2) and pale yellow (2.5Y 7/4) clay, mixed brown (10YR 5/3) and pale brown (10YR 6/3) moist; common fine prominent yellowish brown (10YR 5/6) mottles, yellow (10YR 8/8) moist; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; many moderately thick and thick clay films lining pores and on faces of peds; very strongly acid; abrupt irregular boundary.
B3t—34 to 47 inches; yellow (2.5Y 7/6) clay loam, yellowish brown (10YR 5/6) moist; common fine prominent mottles that are yellowish brown (10YR 5/4, 5/8) when moist and many fine prominent mottles that are dark yellowish brown (10YR 4/6) when moist; weak coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine and fine tubular pores; continuous moderately thick clay films and many thick clay films lining pores and on faces of peds; very strongly acid; gradual wavy boundary.
Cr—47 inches; mixed light yellowish brown (2.5Y 6/4) and pale yellow (2.5Y 7/4) soft sandstone that crushes to loam, light yellowish brown (2.5Y 6/4) moist; many fine prominent yellowish brown (10YR 5/8) and very pale brown (10YR 8/3) mottles, dark yellowish brown (10YR 4/6) and light brownish gray (2.5Y 6/2) moist.

Soft sandstone is at a depth of 40 to 60 inches or more.

The A1 horizon has color of 10YR 4/1, 4/2, 5/2, or 5/3. It is 12 to 18 inches thick and is medium acid or slightly acid. Base saturation is less than 50 percent.

The A2 horizon has color of 10YR 5/2, 6/3, or 7/3. It is loam or silt loam and is 15 to 27 percent clay. The horizon is strongly acid to slightly acid.

The Bt horizon has color of 10YR 6/3, 6/4, or 7/3 or of 2.5Y 6/2, 7/4, or 7/6. It is clay loam or clay.

The Tomales soils in this survey area that are on Point Reyes and are in map units 186, 187, 188, 189, 195, 196, and 197 are taxadjunct to the Tomales series because they have a difference of less than 9 degrees F between the mean summer soil temperature and the mean winter soil temperature. The difference, however, does not significantly affect use and management.

Wittenberg Series

The Wittenberg series consists of deep, well drained soils on uplands. These soils formed in material derived from siliceous shale and sandstone. Slope is 9 to 75 percent.

The Wittenberg soils are loamy-skeletal, mixed, isomesic Typic Dystropepts.

Typical pedon of a Wittenberg very gravelly loam in an area of a Palomarin-Wittenberg complex, 50 to 75 percent slopes; about 2.3 miles west on Stewarts Trail from Five Brooks Trailhead and 100 feet north of Stewarts Trail, in the Point Reyes National Seashore; in Double Point Quadrangle.

O1—4 inches to 0; litter and duff.
A11—0 to 6 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; 40 percent gravel; strongly acid; clear smooth boundary.
A12—6 to 16 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine interstitial pores; 35 percent gravel; strongly acid; diffuse smooth boundary.
A13—16 to 26 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots and few coarse roots; many very fine interstitial pores; 35 percent gravel; strongly acid; clear wavy boundary.
C1—26 to 37 inches; yellowish brown (10YR 5/4) very gravelly loam, brown (7.5YR 4/4) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many very fine and fine interstitial pores and few fine tubular pores; 45 percent gravel; strongly acid; gradual wavy boundary.
C2—37 to 50 inches; brown (7.5YR 5/4) very gravelly loam, brown (7.5YR 4/4) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many very fine and fine interstitial pores; 45 percent gravel; strongly acid; clear irregular boundary.
R—50 inches; hard, highly fractured siliceous shale.

Hard, angular, fractured siliceous shale is at a depth of 40 to 60 inches or more. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F. The profile averages 35 to 60 percent gravel throughout. Base saturation is less than 35 percent throughout the profile.

The A11 horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 3/2, 4/2, or 5/2. It is 20 to 30 inches thick.

The C horizon has color of 10YR 5/3, 5/4, 6/3, or 6/4 or of 7.5YR 5/2, 5/4, 5/6, 6/4, or 6/6. It is very gravelly loam and is 40 to 60 percent gravel.

Yorkville Series

The Yorkville series consists of deep, moderately well drained soils on uplands. These soils formed in material derived from shale. Slope is 9 to 50 percent.

The Yorkville soils are fine, mixed, thermic Typic Argixerolls.

Typical pedon of Yorkville clay loam, 9 to 15 percent slopes, at an intersection point 1.25 miles northeast of the junction of Walker and Chileno Creeks and 1.1 miles west of Chileno Valley Road; in Point Reyes Quadrangle.

A1—0 to 14 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to strong medium granular; hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores and common fine and medium vesicular pores; slightly acid; abrupt wavy boundary.
B21t—14 to 25 inches; mixed grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) clay, mixed very dark grayish brown (10YR 3/2) and strong brown (7.5YR 5/6) moist; strong coarse prismatic structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine interstitial and vesicular pores; many medium thick clay films lining pores and common thin clay films on faces of peds; neutral; abrupt wavy boundary.
B22t—25 to 43 inches; mixed pale olive and gray (5Y 6/3, 5/1) clay, mixed olive and olive gray (5Y 4/3, 4/2) moist; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine interstitial and vesicular pores; common moderately thick clay films lining pores and on faces of peds; many fine irregularly shaped lime seams; moderately alkaline; gradual wavy boundary.
B23t—43 to 51 inches; gray (5Y 6/1, 5/1) clay, mixed dark gray and olive (5Y 4/1, 4/3) moist; weak medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few very fine interstitial pores; common moderately thick clay films lining pores and on faces of peds; many large irregularly shaped lime seams; strongly alkaline; abrupt wavy boundary.
Cr—51 inches; partially decomposed fine grained shale.

Bedrock is at a depth of 40 to 60 inches or more.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. It is 10 to 20 inches thick and is slightly acid or neutral.

The Bt horizon has color of 2.5Y 4/2 or 5/2 or of 5Y 4/1, 4/2, 5/1, or 5/2. It is neutral to strongly alkaline.

Formation of the Soils

Leonard W. Jolley, soil scientist, Soil Conservation Service, helped to prepare this section.

Soil is a natural body on the earth's surface that supports plants. It consists of organic matter and minerals (*8*). The characteristics of a soil at any given point are determined by the interaction of five soil-forming factors—climate, plants and animals, relief, parent material, and time. Each of these factors affects the formation of every soil, and each factor modifies the effects of the other factors. The effect of an individual factor varies from one soil to another, and the interaction among the factors is more complex for some soils than for others.

Climate and plants and animals are the active forces of soil formation. They act on the parent material that has accumulated through the weathering of rocks, and they slowly change this material into soil. Relief modifies the effects of climate and vegetation, mainly by its influence on runoff and temperature. The nature of the parent material also affects the kind of soil that is formed. Time is needed for changing the parent material into soil. Generally, a long time is needed for distinct soil horizons to form.

In the following pages, the five major factors of soil formation are discussed in relation to their effects on the soils in Marin County. Then the morphology of the soils is discussed.

Climate

Climate, which is mainly the distribution of heat and moisture, influences the kinds of soil that form. Temperature and moisture greatly influence the amount and kinds of vegetation, the rate at which organic matter decomposes, the rate at which minerals weather, and the degree of removal or accumulation of material in the different soil horizons.

There are several different climatic regions in the county, and the transition between regions is gradual. The average annual temperature varies only slightly from one region to another; however, the difference between the maximum and minimum temperatures varies greatly. In the coastal region, the average annual temperature is 52 to 54 degrees F and the average annual rainfall is 20 to 50 inches. In the mountainous region, the average annual temperature decreases as elevation increases. On the higher ridges, some of the precipitation in winter is in the form of snow in some years.

Marin County has cool to warm, dry summers and cool, moist winters. Most of the rainfall occurs from November through April. Along the coast, transpiration and evaporation rates are slowed down by fog in summer and some moisture is released from the fog. Fog and rainfall produce soils that have a thick, dark-colored surface horizon.

The soil-forming processes in the county work in cycles. Weathering is relatively rapid in spring and early in summer, but it is slow in fall. Little weathering occurs in winter. Warm temperatures in spring are favorable for rapid soil formation. The warm temperatures permit rapid chemical reactions, and water from the spring rains moves through the soil and removes dissolved or suspended material. The remains of plants decompose rapidly, and the organic acids that are produced hasten the formation of clay.

Rainfall throughout the county is sufficient to leach the soils of soluble bases, thus lowering the soil reaction. The soils commonly are slightly acid to strongly acid.

Generally, weathering and soil formation are more rapid in the cool, moist coastal region. Soils form at a moderate rate in the warmer, drier interior valleys, and they form at a slow rate in the colder areas at higher elevations.

Plants and Animals

Plants, animals, insects, bacteria, and fungi biologically affect soil formation. These biological forces contribute organic matter and nitrogen to the soils, cause gains or losses in plant nutrients, and change the structure and porosity of the soils. Plants generally have a greater effect on soil formation than other living organisms.

Grass is the dominant vegetation along the coastal terraces and along the rolling hills in the east. It is interspersed with oak and hardwood trees, mainly on north-facing side slopes. Bishop pine and Douglas-fir are dominant along Inverness Ridge. East of the San Andreas fault, along Bolinas Ridge, coastal redwood is the dominant vegetation. Various species of ceanothus, manzanita, chamise, and sage are dominant on the shallower soils.

The interior of the county is dominated by oak and grasses. Annual grasses and forbs, many of them

introduced, have largely replaced the native perennials. The north-facing side slopes and canyons commonly have a cover of California-laurel, coast live oak, California buckeye, California black oak, and valley white oak. The drier, south-facing side slopes are covered by grasses, forbs, brush, and chaparral.

The salt marshes, which border San Francisco and San Pablo Bays, are dominated by pickleweed, saltgrass, and cordgrass.

Where organic residue has accumulated from plants, a mat that ranges from less than 1 inch to more than 5 inches in thickness forms on the surface. This mat consists of undecomposed and partially decomposed needles, leaves, and twigs. The reaction of the mat is acid. This contributes to the reaction of the soils, which generally is also acid. Plants on these soils root in the fractures in the bedrock and cause physical and chemical changes. The roots also retard erosion and facilitate the accumulation of soil material. In places, particularly in areas near trees, roots make up more than 20 percent of the upper 2 to 3 feet of the soil. Growth and decomposition of roots tend to make the soils more porous.

In some wooded areas, shrubs are intermingled with coniferous trees. Shrubs generally grow on shallow soils. They also make up a temporary cover after soils have been burned or cleared and until the tree canopy has been reestablished.

Man has directly or indirectly disturbed the soils in the area by mining, clearing or burning the vegetation, harvesting timber, grazing livestock, and cultivating the soils. Repeated burning depletes the organic matter content of the soil, changes the characteristics of the surface layer, and changes the plant community.

Relief

Relief affects soil formation by influencing climate, drainage, plant cover, and soil temperature.

Elevation and slope are factors of relief. Elevation affects the climate under which soils are formed, and slope affects the degree of erosion and runoff. Barnabe and Bonnydoon soils, for example, are steep soils from which erosion removes soil material nearly as fast as it forms, and the more rapid runoff limits the leaching of the soils and the weathering of the parent material. Consequently, the soil profile is thin and the soils are shallow to bedrock.

Aspect, or the direction that a slope faces, has a major effect on the microclimate of the soils (*6*). Aspect largely determines the amount of heat energy that is absorbed from the sun.

Differences in drainage commonly influence the formation of soils. Water readily passes through nearly level or gently sloping soils that are well drained, and more leaching takes place in these soils than in those that are less well drained. Poor drainage, long periods of saturation, and poor aeration commonly cause a chemical transfer or reduction in the soils.

Parent Material

Parent material is the weathered rock or unconsolidated material from which soils form. The mineralogical composition, hardness, grain size, and porosity of the parent material greatly affect the kind of soil that is formed. Parent material in Marin County is related mainly to the composition of the geologic formations.

The San Andreas fault zone separates the geology of the Point Reyes Peninsula from that of the rest of the county. West of the fault zone, granitic rock such as quartz-diorite and granodiorite forms the backbone of the Point Reyes peninsula. It extends along the Inverness Ridge from Mount Wittenberg to the northern tip of the peninsula. The dominant soils that formed in this area are the Inverness, Kehoe, and Sheridan Variant soils.

Overlying the granitic rock are Miocene Monterey Shale and associated sandstone, which cover much of the peninsula from Bolinas to Abbott's Lagoon. Chert, porcelanite, shale, and sandstone are in this area. The dominant soils that formed in this area are the Palomarin and Wittenberg soils in areas of woodland and the Pablo and Bayview soils in areas of coastal brush and grassland.

The other major type of parent material is the Drakes Bay Formation of Pliocene age. It is composed mainly of mudstone, siltstone, and greenish sandstone. This formation covers the area between Point Reyes, Abbott's Lagoon, and Limantour Beach. The softness of this material results in rounded and rolling topography. The Steinbeck and Tomales fine sandy loams are associated with this parent material.

East of the San Andreas fault zone, parent material of the Franciscan Formation is dominant. The Franciscan Formation consists of sandstone, graywacke, dark-colored or black shale, rhythmically interbedded radiolarian red chert and shale, some volcanic rock, and greenstone (*4*). A significant amount of the Franciscan Formation in Marin County is melange (*5*). Melange is disrupted rock masses and sheared and crushed matrix material that is the result of tectonic plate activity between the North American and Pacific plates. Subsequent uplifts have exposed the rock.

Depending on the type of parent material and the degree of metamorphism, various kinds of soil have formed. Bonnydoon, Saurin, and Tocaloma soils formed in material derived from sandstone and shale. Barnabe Variant and Tamalpais soils formed mainly in material derived from radiolarian chert and greenstone in the vicinity of the Marin Headlands. Los Osos and Yorkville soils are derived mainly from melange and metamorphosed rock. Slides, soil flows, and rock

outcroppings are common on the Franciscan Formation, particularly in the melange areas.

Ultrabasic rock forms intrusions in the Franciscan Formation, and it commonly has been altered to serpentinite. The Henneke and Montara soils formed in parent material derived from serpentinite and other related rock.

In the northwestern corner of the county, the Merced Formation of Pliocene age overlies the Franciscan Formation. It is made up of sandstone, conglomerate, clay shale, and some interbedded tuff. The Steinbeck and Tomales soils formed in material derived from this formation.

Small areas of the Sonoma volcanic field are in the northeastern corner of the county, particularly on Burdell Mountain. The Bonnydoon Variant, Gilroy, and Gilroy Variant soils formed in these areas.

An area of massive, coarse-textured conglomerate rock is east of Novato. The Bressa Variant and McMullin Variant soils formed in material derived from this rock.

The youngest geologic material in the county is recent alluvial deposits of sand, silt, and clay. Soils that formed in these deposits have only a few characteristics that are influenced by mineralogy. Some of the soils that formed in recent alluvium are Cortina, Cole, Clear Lake, Novato, and Reyes soils.

Time

Soil properties are dependent on the length of time the soil-forming factors have been interacting. The soils of Marin County range from young to old. The young soils exhibit little if any alteration of parent material or formation of distinct horizons. The old soils have highly altered parent material and well defined horizons.

The Cortina, Ballard, and Los Osos soils are examples of soils that have different characteristics mostly because of the differences in the length of time the soils have been in place. The Cortina soils are young and do not have well developed horizons other than an accumulation of organic matter in the A horizon. The Ballard soils are at a slightly higher elevation than the Cortina soils, and they have been stable long enough for an argillic horizon to develop. Thus, in the Ballard soils the B horizon contains more clay than the A horizon, any carbonates that were in the parent material have been leached, and reaction is slightly acid. The Los Osos soils, which are on uplands, are relatively old and are well developed. They have a B horizon that is clay and is slightly acid or neutral.

The oldest soils may not form in the oldest geologic formation. Where soils are very steep or steep, geologic erosion and soil creep may equal soil formation and weathering. Thus, a young soil is formed.

Morphology of Soils

Several processes are involved in the formation of soil horizons. The differentiation of soil horizons is the result of one or more of the following processes: (1) accumulation of organic matter, (2) leaching of calcium carbonate and bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals.

The accumulation of organic matter in the upper part of the profile forms an A1 horizon and is a major process of horizon development. The organic matter content of the soils in Marin County ranges from very low to high. Nearly all the soils in the county have been leached of carbonates and bases to some extent.

The translocation of clay minerals has contributed greatly to horizon development in many soils. An argillic horizon is formed by the weathering of primary minerals to silicate clay and the subsequent translocation and accumulation of clay in the lower horizons. Clay films in pores and on peds of the B horizon are evidence of clay illuviation.

The reduction of iron, or gleying, is evidenced by the gray color of the B and C horizons of poorly drained soils in the county. Some horizons have reddish brown mottles and concretions, which indicate segregation of iron. The pale brown color of the A2 horizon of the well drained Steinbeck soils, however, resulted from the translocation of iron rather than from the reduction of iron.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Austin, Morris E. 1965. Land resource regions and major land resource areas of the United States. U.S. Dep. Agric. Handb. 296, 82 pp., map.

(4) Baily, Edgar H., William P. Irwin, and David L. Jones. 1964. Franciscan and related rocks, and their significance in the geology of western California. Calif. Div. of Mines and Geol. Bull. 183, 171 pp., map.

(5) Hsu, K. J. 1968. Principles of melanges and their bearing on the Franciscan-Knoxville paradox. Geol. Soc. of Amer. Bull. vol. 79, no. 8, pp. 1063-1074.

(6) Smith, G. D., F. Newhall, L. H. Robinson, and D. Swanson. 1964. Soil temperature regimes: their characteristics and predictability. Soil Conserv. Serv. Tech. Pap. 144, 14 pp., illus.

(7) United States Department of Agriculture, Bureau of Soils. 1917. Reconnaissance Soil Survey of the San Francisco Bay Region, California, 112 pp., map.

(8) United States Department of Agriculture. 1938. Soils and men. U.S. Dep. Agric. Yearbk. 1,232 pp., illus.

(9) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(10) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(11) Zinke, Paul J. 1958. Site quality for Douglas-fir and ponderosa pine in northwestern California as related to climate, topography, and soil. Proceedings of Society of American Foresters, pp. 167-171, illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.5
Low	2.5 to 5
Moderate	5 to 7.5
High	7.5 to 10
Very high	More than 10

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree o acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AT KENTFIELD AND SAN RAFAEL

[Recorded in the period 1970-1975]

Month	Kentfield			San Rafael		
	Average daily maximum	Average daily minimum	Average daily	Average daily maximum	Average daily minimum	Average daily
	°F	°F	°F	°F	°F	°F
January-----	55.2	38.4	46.8	57.6	41.0	49.3
February----	60.5	40.8	50.6	62.4	43.8	53.1
March-------	63.6	41.5	52.5	65.2	44.3	54.7
April-------	68.6	43.2	55.9	69.3	45.7	57.5
May---------	74.4	46.3	60.3	74.2	48.6	61.4
June--------	79.2	50.0	64.6	78.8	52.5	65.6
July--------	83.5	50.5	67.0	82.4	53.2	67.8
August------	82.8	50.6	66.7	82.1	53.7	67.9
September---	81.1	50.2	65.6	81.9	53.5	67.7
October-----	74.0	47.3	60.6	76.0	50.8	63.4
November----	63.1	43.4	53.3	65.4	46.3	55.9
December----	56.2	39.2	47.7	58.4	42.5	50.4
Annual------	70.2	45.1	57.6	71.1	47.9	59.6

TABLE 2.--PRECIPITATION AT KENTFIELD, NOVATO,
POINT REYES STATION, AND SAN RAFAEL

Month	Kentfield[1/]	Novato[2/]	Point Reyes[2/] Station	San Rafael[1/]
	In	In	In	In
January-------	11.37	6.81	5.93	8.65
February------	7.60	5.04	5.87	5.33
March---------	5.66	3.57	3.23	4.52
April---------	3.42	2.08	2.31	2.02
May-----------	1.08	0.99	1.08	0.48
June----------	0.39	0.20	0.38	0.29
July----------	0.01	3/	3/	0.07
August--------	0.11	0.06	0.01	0.09
September-----	0.31	0.66	0.11	0.49
October-------	2.89	1.56	1.71	2.08
November------	5.69	3.05	4.03	5.12
December------	10.08	5.52	5.19	7.45
Annual--------	48.61	29.54	29.85	36.59

1/ Recorded in the period 1970-1975.

2/ Recorded in the period 1931-1960.

3/ Trace.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
101	Ballard gravelly loam, 2 to 9 percent slopes	1,855	0.6
102	Ballard-Urban land complex, 0 to 9 percent slopes	770	0.2
103	Barnabe very gravelly loam, 30 to 50 percent slopes	830	0.2
104	Beaches	1,380	0.4
105	Blucher-Cole complex, 2 to 5 percent slopes	9,290	2.8
106	Bonnydoon gravelly loam, 15 to 30 percent slopes	575	0.2
107	Bonnydoon gravelly loam, 30 to 75 percent slopes	5,070	1.5
108	Bonnydoon Variant-Gilroy-Gilroy Variant loams, 50 to 75 percent slopes	2,470	0.7
109	Bressa Variant-McMullin Variant complex, 30 to 50 percent slopes	1,410	0.4
110	Centissima-Barnabe complex, 15 to 30 percent slopes	850	0.3
111	Centissima-Barnabe complex, 30 to 50 percent slopes	2,470	0.7
112	Centissima-Barnabe complex, 50 to 75 percent slopes	5,140	1.5
113	Clear Lake clay	990	0.3
114	Cortina gravelly sandy loam, 0 to 5 percent slopes	885	0.3
115	Cronkhite-Barnabe complex, 9 to 15 percent slopes	2,315	0.7
116	Cronkhite-Barnabe complex, 15 to 30 percent slopes	3,230	1.0
117	Cronkhite-Barnabe complex, 30 to 50 percent slopes	3,990	1.2
118	Cronkhite-Barnabe complex, 50 to 75 percent slopes	2,515	0.8
119	Dipsea-Barnabe very gravelly loams, 30 to 50 percent slopes	1,995	0.6
120	Dipsea-Barnabe very gravelly loams, 50 to 75 percent slopes	8,905	2.7
121	Dipsea-Urban land-Barnabe complex, 30 to 50 percent slopes	505	0.2
122	Dune land	3,650	1.1
123	Felton Variant-Soulajule complex, 9 to 15 percent slopes	790	0.2
124	Felton Variant-Soulajule complex, 15 to 30 percent slopes	1,010	0.3
125	Felton Variant-Soulajule complex, 30 to 50 percent slopes	2,410	0.7
126	Felton Variant-Soulajule complex, 50 to 75 percent slopes	1,115	0.3
127	Fluvents, channeled	855	0.3
128	Gilroy-Gilroy Variant-Bonnydoon Variant loams, 30 to 50 percent slopes	2,910	0.9
129	Henneke stony clay loam, 15 to 50 percent slopes	3,065	0.9
130	Humaquepts, seeped	545	0.2
131	Hydraquents, saline	1,820	0.5
132	Inverness loam, 9 to 15 percent slopes	930	0.3
133	Inverness loam, 15 to 30 percent slopes	890	0.3
134	Inverness loam, 30 to 50 percent slopes	670	0.2
135	Inverness loam, 50 to 75 percent slopes	3,250	1.0
136	Kehoe loam, 9 to 15 percent slopes	1,245	0.4
137	Kehoe loam, 15 to 50 percent slopes	1,300	0.4
138	Kehoe Variant coarse sandy loam, 9 to 15 percent slopes	500	0.2
139	Kehoe Variant coarse sandy loam, 15 to 50 percent slopes	2,605	0.8
140	Los Osos-Bonnydoon complex, 5 to 15 percent slopes	2,840	0.9
141	Los Osos-Bonnydoon complex, 15 to 30 percent slopes	5,725	1.7
142	Los Osos-Bonnydoon complex, 30 to 50 percent slopes	12,930	3.9
143	Los Osos-Urban land-Bonnydoon complex, 15 to 30 percent slopes	625	0.2
144	Los Osos-Urban land-Bonnydoon complex, 30 to 50 percent slopes	550	0.2
145	Maymen-Maymen Variant gravelly loams, 30 to 75 percent slopes	7,945	2.4
146	Montara clay loam, 15 to 30 percent slopes	205	0.1
147	Novato clay	3,065	0.9
148	Olompali loam, 2 to 9 percent slopes	1,070	0.3
149	Olompali loam, 9 to 15 percent slopes	3,200	1.0
150	Olompali loam, 15 to 30 percent slopes	1,785	0.5
151	Pablo-Bayview complex, 15 to 50 percent slopes	3,405	1.0
152	Pablo-Bayview complex, 50 to 75 percent slopes	2,375	0.7
153	Palomarin-Wittenberg complex, 9 to 15 percent slopes	660	0.2
154	Palomarin-Wittenberg complex, 15 to 30 percent slopes	2,460	0.7
155	Palomarin-Wittenberg complex, 30 to 50 percent slopes	2,855	0.9
156	Palomarin-Wittenberg complex, 50 to 75 percent slopes	6,855	2.1
157	Pits, quarries	320	0.1
158	Reyes clay	7,800	2.3
159	Rock outcrop-Xerorthents complex, 50 to 75 percent slopes	1,570	0.5
160	Rodeo clay loam, 2 to 15 percent slopes	3,440	1.0
161	Saurin-Bonnydoon complex, 2 to 15 percent slopes	1,090	0.3
162	Saurin-Bonnydoon complex, 15 to 30 percent slopes	2,650	0.8
163	Saurin-Bonnydoon complex, 30 to 50 percent slopes	5,990	1.8
164	Saurin-Bonnydoon complex, 50 to 75 percent slopes	4,590	1.4
165	Saurin-Urban land-Bonnydoon complex, 15 to 30 percent slopes	665	0.2
166	Saurin-Urban land-Bonnydoon complex, 30 to 50 percent slopes	1,320	0.4
167	Sheridan Variant coarse sandy loam, 9 to 30 percent slopes	1,425	0.4
168	Sheridan Variant coarse sandy loam, 30 to 50 percent slopes	1,425	0.4
169	Sheridan Variant coarse sandy loam, 50 to 75 percent slopes	1,290	0.4
170	Sirdrak sand, 2 to 15 percent slopes	2,185	0.7
171	Sirdrak sand, 15 to 50 percent slopes	525	0.2
172	Sirdrak Variant sand, 0 to 5 percent slopes	1,465	0.4

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
173	Sobega loam, 9 to 15 percent slopes	2,455	0.7
174	Sobega loam, 15 to 30 percent slopes	675	0.2
175	Tamalpais-Barnabe Variant very gravelly loams, 15 to 30 percent slopes	630	0.2
176	Tamalpais-Barnabe Variant very gravelly loams, 30 to 50 percent slopes	2,305	0.7
177	Tamalpais-Barnabe Variant very gravelly loams, 50 to 75 percent slopes	1,770	0.5
178	Tocaloma-McMullin complex, 15 to 30 percent slopes	350	0.1
179	Tocaloma-McMullin complex, 30 to 50 percent slopes	7,545	2.3
180	Tocaloma-McMullin complex, 50 to 75 slopes	25,430	7.6
181	Tocaloma-McMullin-Urban land complex, 15 to 30 percent slopes	1,075	0.3
182	Tocaloma-McMullin-Urban land complex, 30 to 50 percent slopes	4,700	1.4
183	Tocaloma-Saurin association, steep	945	0.3
184	Tocaloma-Saurin association, very steep	17,915	5.4
185	Tocaloma-Saurin association, extremely steep	24,565	7.4
186	Tomales fine sandy loam, 2 to 9 percent slopes	665	0.2
187	Tomales fine sandy loam, 9 to 15 percent slopes	2,705	0.8
188	Tomales fine sandy loam, 15 to 30 percent slopes	920	0.3
189	Tomales fine sandy loam, 30 to 50 percent slopes	2,390	0.7
190	Tomales loam, 2 to 9 percent slopes	830	0.2
191	Tomales loam, 9 to 15 percent slopes	5,265	1.6
192	Tomales loam, 15 to 30 percent slopes	4,815	1.4
193	Tomales loam, 30 to 50 percent slopes	3,230	1.0
194	Tomales-Sobega loams, 15 to 30 percent slopes	675	0.2
195	Tomales-Sobega complex, 9 to 15 percent slopes	685	0.2
196	Tomales-Sobega complex, 15 to 30 percent slopes	960	0.3
197	Tomales-Steinbeck fine sandy loams, 30 to 50 percent slopes	470	0.1
198	Tomales-Steinbeck loams, 5 to 15 percent slopes	6,175	1.9
199	Tomales-Steinbeck loams, 15 to 30 percent slopes	1,955	0.6
200	Tomales-Steinbeck loams, 30 to 50 percent slopes	400	0.1
201	Urban land-Ballard complex, 0 to 9 percent slopes	940	0.3
202	Urban land-Xerorthents complex, 0 to 9 percent slopes	3,635	1.1
203	Xerorthents, fill	2,440	0.7
204	Xerorthents-Urban land complex, 0 to 9 percent slopes	10,115	3.0
205	Yorkville clay loam, 9 to 15 percent slopes	360	0.1
206	Yorkville clay loam, 15 to 30 percent slopes	1,155	0.3
207	Yorkville clay loam, 30 to 50 percent slopes	5,780	1.7
208	Yorkville-Rock outcrop complex, 9 to 15 percent slopes	615	0.2
209	Yorkville-Rock outcrop complex, 15 to 30 percent slopes	1,960	0.6
	Total	332,800	100.0

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
101---------- Ballard	Loamy Bottomland(14)----------	Favorable	2,600	Soft chess----------	30
		Normal	2,000	Ripgut brome----------	10
		Unfavorable	1,200	Needlegrass----------	10
				Filaree----------	10
				Burclover----------	10
				Wild oat----------	5
				Foxtail fescue----------	5
				Red brome----------	5
				Foxtail barley----------	5
103---------- Barnabe	Coastal Shallow Gravelly Loamy(15).	Favorable	2,800	Soft chess----------	20
		Normal	2,400	Ripgut brome----------	15
		Unfavorable	1,600	Wild oat----------	10
				Purple needlegrass----------	10
				Blue wildrye----------	10
				Coyotebrush----------	10
				Plantain----------	5
				Pearly everlasting----------	5
				Hedgenettle----------	5
105*:					
Blucher----------	Clayey Bottomland(14)----------	Favorable	3,000	Blue wildrye----------	30
		Normal	2,500	Soft chess----------	15
		Unfavorable	1,500	Fescue----------	10
				Ripgut brome----------	10
				Italian ryegrass----------	10
				Poison-oak----------	10
				Velvetgrass----------	5
				Rush----------	5
Cole----------	Clayey Bottomland(14)----------	Favorable	3,000	Soft chess----------	15
		Normal	2,500	Beardless wildrye----------	15
		Unfavorable	1,500	Burclover----------	15
				Italian ryegrass----------	10
				Wild oat----------	10
				Filaree----------	10
				Mediterranean barley----------	5
				Foxtail fescue----------	5
				Dock----------	5
				Baltic rush----------	5
				Narrowleaf plantain----------	5
106, 107---------- Bonnydoon	Shallow Gravelly Loamy(15)----	Favorable	3,800	Soft chess----------	15
		Normal	3,200	Ripgut brome----------	15
		Unfavorable	2,200	California oatgrass----------	15
				Purple needlegrass----------	15
				Wild oat----------	10
				Broadleaf filaree----------	10
				Burclover----------	10
				Soap plant----------	5
108*:					
Bonnydoon Variant-	Shallow Loamy(15)----------	Favorable	2,600	Wild oat----------	25
		Normal	2,000	Soft chess----------	20
		Unfavorable	800	Broadleaf filaree----------	20
				Burclover----------	10
				Italian ryegrass----------	10
				Mediterranean barley----------	5
				Ripgut brome----------	5
				Blue-eyegrass----------	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
108*:					
Gilroy	Fine Loamy(15)	Favorable	3,100	Soft chess	20
		Normal	2,300	Wild oat	15
		Unfavorable	1,500	Filaree	15
				Red brome	5
				Burclover	5
				Ripgut brome	5
				Needlegrass	5
				Foxtail fescue	5
				Blue wildrye	5
				Clover	5
Gilroy Variant	Fine Loamy(15)	Favorable	2,400	Wild oat	25
		Normal	1,800	Soft chess	20
		Unfavorable	1,200	Broadleaf filaree	15
				Ripgut brome	10
				Italian ryegrass	10
				Burclover	5
				Turkeymullein	5
				California live oak	5
110*, 111*, 112*: Centissima.					
Barnabe	Coastal Shallow Gravelly Loamy(15).	Favorable	2,800	Soft chess	20
		Normal	2,400	Ripgut brome	15
		Unfavorable	1,600	Wild oat	10
				Purple needlegrass	10
				Blue wildrye	10
				Coyotebrush	10
				Plantain	5
				Pearly everlasting	5
				Hedgenettle	5
113 Clear Lake	Clayey Bottomland(14)	Favorable	3,000	Soft chess	15
		Normal	2,500	Burclover	15
		Unfavorable	1,500	Filaree	15
				Wild oat	10
				Beardless wildrye	10
				Italian ryegrass	10
				Ripgut brome	5
				Narrowleaf plantain	5
				Tarweed	5
				Common velvetgrass	5
114 Cortina	Gravelly Sandy Loamy(14)	Favorable	1,000	Wild oat	15
		Normal	800	Redstem filaree	10
		Unfavorable	400	Soft chess	10
				Ripgut brome	10
				Burclover	10
				Italian ryegrass	10
				Mediterranean barley	10
				Dock	5
				Narrowleaf plantain	5
				Foxtail fescue	5
				Broadleaf filaree	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
115*, 116*, 117*, 118*:					
Cronkhite	Coastal Loamy Claypan(15)	Favorable	2,800	California oatgrass	20
		Normal	2,400	Purple needlegrass	15
		Unfavorable	1,800	Soft chess	15
				Coyotebrush	10
				Blue wildrye	10
				Wild oat	5
				Plantain	5
				Lupine	5
				Scotch-broom	5
				Blackberry	5
				Poison-oak	5
Barnabe	Coastal Shallow Gravelly Loamy(15).	Favorable	2,800	Soft chess	20
		Normal	2,400	Ripgut brome	15
		Unfavorable	1,600	Wild oat	10
				Purple needlegrass	10
				Blue wildrye	10
				Coyotebrush	10
				Plantain	5
				Pearly everlasting	5
				Hedgenettle	5
119*, 120*: Dipsea.					
Barnabe	Coastal Shallow Gravelly Loamy(15).	Favorable	2,800	Soft chess	20
		Normal	2,400	Ripgut brome	15
		Unfavorable	1,600	Wild oat	10
				Purple needlegrass	10
				Blue wildrye	10
				Coyotebrush	10
				Plantain	5
				Pearly everlasting	5
				Hedgenettle	5
121*: Dipsea.					
Urban land.					
Barnabe	Coastal Shallow Gravelly Loamy(15).	Favorable	2,800	Soft chess	20
		Normal	2,400	Ripgut brome	15
		Unfavorable	1,600	Wild oat	10
				Purple needlegrass	10
				Blue wildrye	10
				Coyotebrush	10
				Plantain	5
				Pearly everlasting	5
				Hedgenettle	5
123*, 124*, 125*, 126*:					
Felton Variant	Loamy(15)	Favorable	2,800	Wild oat	15
		Normal	2,400	Soft chess	15
		Unfavorable	1,500	California oatgrass	15
				Needlegrass	10
				Foxtail fescue	10
				Burclover	10
				Narrowleaf plantain	5
				Coyotebrush	5
				Rush	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
123*, 124*, 125*, 126*:					
Soulajule	Loamy(15)	Favorable	2,400	Wild oat	20
		Normal	2,200	Burclover	10
		Unfavorable	1,200	Needlegrass	10
				Blue wildrye	10
				Carex	10
				Soft chess	10
				Ripgut brome	5
				Plantain	5
128*:					
Gilroy	Fine Loamy(15)	Favorable	3,100	Soft chess	20
		Normal	2,300	Wild oat	15
		Unfavorable	1,500	Filaree	15
				Red brome	5
				Burclover	5
				Ripgut brome	5
				Needlegrass	5
				Foxtail fescue	5
				Blue wildrye	5
				Clover	5
Gilroy Variant	Fine Loamy(15)	Favorable	2,400	Wild oat	25
		Normal	1,800	Soft chess	20
		Unfavorable	1,200	Broadleaf filaree	15
				Ripgut brome	10
				Italian ryegrass	10
				Burclover	5
				Turkeymullein	5
				California live oak	5
Bonnydoon Variant-	Shallow Loamy(15)	Favorable	2,600	Wild oat	25
		Normal	2,000	Soft chess	20
		Unfavorable	800	Broadleaf filaree	20
				Burclover	10
				Italian ryegrass	10
				Mediterranean barley	5
				Ripgut brome	5
				Blue-eyegrass	5
129 Henneke	Shallow Clayey Serpentine(15)	Favorable	800	Chamise	20
		Normal	600	Buckbrush	10
		Unfavorable	500	Manzanita	10
				Leather oak	10
				Ceanothus	5
				California scrub oak	5
				Purple needlegrass	5
				Foxtail fescue	5
				Bottlebrush squirreltail	5
				Soap plant	5
				Wild oat	5
				Digger pine	5
132, 133 Inverness	Coastal Loamy (15)	Favorable	3,500	Common wheatgrass	25
		Normal	2,900	California brome	20
		Unfavorable	2,500	Fescue	15
				Western swordfern	10
				Wild oat	5
				Ripgut brome	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
136, 137---------- Kehoe	Coastal Loamy(15)----------	Favorable	3,500	Coyotebrush----------	20
		Normal	2,900	Soft chess----------	15
		Unfavorable	2,500	Reedgrass----------	15
				Iris----------	10
				Perennial ryegrass----------	10
				Blue wildrye----------	10
				Brackenfern----------	5
				Himalayaberry----------	5
				Plantain----------	5
138, 139---------- Kehoe Variant	Coastal Coarse Loamy(15)------	Favorable	4,000	Bush lupine----------	25
		Normal	3,500	Soft chess----------	20
		Unfavorable	2,600	Ripgut brome----------	15
				Italian ryegrass----------	10
				Foxtail barley----------	5
				Thistle----------	5
				Coyotebrush----------	5
				Foxtail fescue----------	5
140*, 141*, 142*:					
Los Osos----------	Fine Loamy Claypan(15)--------	Favorable	3,500	Wild oat----------	20
		Normal	3,000	Soft chess----------	20
		Unfavorable	2,000	Burclover----------	10
				Filaree----------	10
				Ripgut brome----------	5
				Red brome----------	5
				Clover----------	5
				Oak----------	5
				Blue oak----------	5
				Annual lupine----------	5
Bonnydoon---------	Shallow Gravelly Loamy(15)----	Favorable	3,800	Soft chess----------	15
		Normal	3,200	Ripgut brome----------	15
		Unfavorable	2,200	California oatgrass----------	15
				Purple needlegrass----------	15
				Wild oat----------	10
				Broadleaf filaree----------	10
				Burclover----------	10
				Soap plant----------	5
145*:					
Maymen----------	Steep Shallow Coarse Loamy(15)	Favorable	2,600	Manzanita----------	40
		Normal	2,400	Chamise----------	15
		Unfavorable	800	California scrub oak----------	15
				Ceanothus----------	10
Maymen Variant----	Steep Coarse Loamy(15)--------	Favorable	2,600	Manzanita----------	60
		Normal	2,400	Chamise----------	10
		Unfavorable	800	Ceanothus----------	5
				California scrub oak----------	5
146---------- Montara	Shallow Fine Loamy Serpentine(15).	Favorable	1,400	Foxtail fescue----------	15
		Normal	900	Red brome----------	10
		Unfavorable	600	Soft chess----------	10
				Chamise----------	15
				Buckbrush----------	10
				Whiteleaf manzanita----------	10
				Bottlebrush squirreltail------	5
				Purple needlegrass----------	5
				California yerba-santa--------	5
				Digger pine----------	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
148, 149, 150----- Olompali	Coastal Loamy Claypan(15)-----	Favorable	3,000	California oatgrass----------	15
		Normal	2,500	Wild oat----------	15
				Spike bentgrass----------	10
				Purple needlegrass----------	10
				Plantain----------	5
				Foxtail fescue----------	5
				Common velvetgrass----------	5
				Douglas iris----------	5
				Kellogg bluegrass----------	5
151*, 152*:					
Pablo----------	Coastal Shallow Loamy(15)-----	Favorable	3,000	Brackenfern----------	10
		Normal	2,500	Blackberry----------	10
		Unfavorable	1,800	Coyotebrush----------	10
				Poison-oak----------	10
				Velvetgrass----------	5
				Blue wildrye----------	5
				California oatgrass----------	5
				Bentgrass----------	5
				Mountain brome----------	5
				Perennial ryegrass----------	5
				Wild pea----------	5
				California buckthorn----------	5
				Western thimbleberry----------	5
Bayview----------	Coastal Shallow Gravelly Loamy(15).	Favorable	2,000	Coyotebrush----------	20
		Normal	1,800	Needlegrass----------	15
		Unfavorable	1,600	Bentgrass----------	10
				Brackenfern----------	10
				Mountain brome----------	5
				Blue wildrye----------	5
				Soft chess----------	5
				Iris----------	5
				Yarrow----------	5
				Buckwheat----------	5
				Poison-oak----------	5
				California sagebrush----------	5
				Buckwheat----------	5
158---------- Reyes	Acid Subirrigated(14)----------	Favorable	2,000	Australian saltbush----------	70
		Normal	1,500	Saltgrass----------	15
		Unfavorable	1,000	Coyotebrush----------	15
160---------- Rodeo	Clayey Bottomland(15)----------	Favorable	4,000	California oatgrass----------	15
		Normal	3,000	Plantain----------	10
		Unfavorable	2,500	Soft chess----------	10
				Wild oat----------	10
				Fescue----------	5
				Perennial ryegrass----------	5
				Foxtail fescue----------	5
				Rush----------	5
				Ripgut brome----------	5
				Dock----------	5
				Orchardgrass----------	5
				Barley----------	5
				Beardless wildrye----------	5
				Thistle----------	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
161*, 162*, 163*, 164*:					
Saurin	Loamy(15)	Favorable	4,000	Soft chess	15
		Normal	3,000	Idaho fescue	10
		Unfavorable	2,000	Wild oat	10
				Ripgut brome	10
				Bottlebrush squirreltail	10
				Italian ryegrass	10
				Broadleaf filaree	10
				California oatgrass	10
				Purple needlegrass	10
				Blue wildrye	5
Bonnydoon	Shallow Gravelly Loamy(15)	Favorable	3,800	Soft chess	15
		Normal	3,200	Ripgut brome	15
		Unfavorable	2,200	California oatgrass	15
				Wild oat	10
				Broadleaf filaree	10
				Burclover	10
170, 171 Sirdrak	Sandy(15)	Favorable	2,700	Bush lupine	30
		Normal	2,400	Ripgut brome	20
				Mediterranean barley	10
				Soft chess	10
				Brackenfern	5
				Mustard	5
172 Sirdrak Variant	Sandy(15)	Favorable	2,800	Coyotebrush	20
		Normal	2,400	Bush lupine	15
		Unfavorable	2,000	Blue wildrye	15
				Ripgut brome	10
				Perennial ryegrass	10
				Common velvetgrass	10
				Brackenfern	5
				Plantain	5
				California brome	5
				Blackberry	5
173, 174 Sobega	Loamy(15)	Favorable	3,000	Wild oat	15
		Normal	2,500	Soft chess	15
		Unfavorable	1,800	Broadleaf filaree	15
				Burclover	10
				Mediterranean barley	10
				Needlegrass	10
				Foxtail fescue	5
				Italian ryegrass	5
				Narrowleaf plantain	5
				California sagebrush	5
175*, 176*, 177*:					
Tamalpais	Coastal Gravelly Loamy(15)	Favorable	2,400	Coyotebrush	20
		Normal	1,800	Needlegrass	15
		Unfavorable	900	Perennial ryegrass	10
				Brackenfern	5
				Buckwheat	5
				Bentgrass	5
				Narrowleaf plantain	5
				California sagebrush	5
				Poison-oak	5
				Carex	5
				Lupine	5
				Pearly everlasting	5
				Blackberry	5
				Hairgrass	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
175*, 176*, 177*:					
Barnabe Variant---	Coastal Shallow Gravelly Loamy(15).	Favorable	900	California sagebrush----------	25
		Normal	700	Coyotebrush----------	15
				Soap plant----------	10
				Buckwheat----------	5
				Hairgrass----------	5
				Wild oat----------	5
				Italian ryegrass----------	5
Tocaloma.					
Saurin----------	Loamy(15)----------	Favorable	4,000	Soft chess----------	15
		Normal	3,000	Idaho fescue----------	10
				Ripgut brome----------	10
				Bottlebrush squirreltail------	10
				Italian ryegrass----------	10
				Broadleaf filaree----------	10
				California oatgrass----------	10
				Purple needlegrass----------	10
				Blue wildrye----------	5
186, 187, 188, 189, 190, 191, 192, 193---------- Tomales	Coastal Loamy Claypan(15)-----	Favorable	3,000	Blue wildrye----------	15
		Normal	2,500	Pacific reedgrass----------	15
		Unfavorable	2,000	Soft chess----------	10
				Redtop----------	10
				Slender hairgrass----------	10
				Brackenfern----------	5
				Coyotebrush----------	5
				Silver hairgrass----------	5
				Foxtail fescue----------	5
				Himalayaberry----------	5
				Perennial ryegrass----------	5
				Common velvetgrass----------	5
194*, 195*, 196*: Tomales----------	Coastal Loamy Claypan(15)-----	Favorable	3,000	Blue wildrye----------	15
		Normal	2,500	Pacific reedgrass----------	15
		Unfavorable	2,000	Soft chess----------	10
				Redtop----------	10
				Slender hairgrass----------	10
				Brackenfern----------	5
				Coyotebrush----------	5
				Silver hairgrass----------	5
				Foxtail fescue----------	5
				Himalayaberry----------	5
				Perennial ryegrass----------	5
				Common velvetgrass----------	5
Sobega----------	Loamy(15)----------	Favorable	3,000	Wild oat----------	15
		Normal	2,500	Soft chess----------	15
		Unfavorable	1,800	Broadleaf filaree----------	15
				Burclover----------	10
				Mediterranean barley----------	10
				Needlegrass----------	10
				Foxtail fescue----------	5
				Italian ryegrass----------	5
				Narrowleaf plantain----------	5
				California sagebrush----------	5

See footnote at end of table.

TABLE 4.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
197*, 198*, 199*, 200*:					
Tomales	Coastal Loamy Claypan(15)	Favorable	3,000	Blue wildrye	15
		Normal	2,500	Pacific reedgrass	15
		Unfavorable	2,000	Soft chess	10
				Redtop	10
				Slender hairgrass	10
				Brackenfern	5
				Coyotebrush	5
				Silver hairgrass	5
				Foxtail fescue	5
				Himalayaberry	5
				Perennial ryegrass	5
				Common velvetgrass	5
Steinbeck	Coastal Loamy(15)	Favorable	3,000	Soft chess	15
		Normal	2,500	Burclover	10
		Unfavorable	1,800	Whitestem filaree	10
				California oatgrass	10
				Blue wildrye	10
				Purple needlegrass	10
				Wild oat	5
				Perennial ryegrass	5
				Foxtail fescue	5
				Mouse barley	5
				Annual bluegrass	5
205, 206, 207--- Yorkville	Fine Loamy Claypan(15)	Favorable	3,300	Soft chess	20
		Normal	2,800	Burclover	15
		Unfavorable	1,200	California oatgrass	10
				Purple needlegrass	10
				Wild oat	5
				Silver hairgrass	5
				Barley	5
				Foxtail fescue	5
				Italian ryegrass	5
				Medusahead	5
				Dogtail	5
208*, 209*:					
Yorkville	Fine Loamy Claypan(15)	Favorable	3,300	Soft chess	20
		Normal	2,800	Burclover	15
		Unfavorable	1,200	California oatgrass	10
				Purple needlegrass	10
				Wild oat	5
				Silver hairgrass	5
				Barley	5
				Foxtail fescue	5
				Italian ryegrass	5
				Medusahead	5
				Dogtail	5
Rock outcrop.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
110*: Centissima	1o	Slight	Moderate	Slight	Moderate	Douglas-fir	200	Douglas-fir, redwood.
						Redwood	160	
						California-laurel	---	
						Tanoak	---	
Barnabe.								
111*: Centissima	1r	Moderate	Moderate	Slight	Moderate	Douglas-fir	200	Douglas-fir, redwood.
						Redwood	160	
						California-laurel	---	
						Tanoak	---	
Barnabe.								
112*: Centissima	1r	Severe	Moderate	Slight	Moderate	Douglas-fir	200	Douglas-fir, redwood.
						Redwood	160	
						California-laurel	---	
						Tanoak	---	
Barnabe.								
119*: Dipsea	2r	Moderate	Moderate	Slight	Moderate	Redwood	190	Redwood, Douglas-fir.
						Douglas-fir	182	
Barnabe.								
120*: Dipsea	2r	Severe	Moderate	Slight	Moderate	Redwood	190	Redwood, Douglas-fir.
						Douglas-fir	182	
Barnabe.								
121*: Dipsea	2r	Moderate	Moderate	Slight	Moderate	Redwood	190	Redwood, Douglas-fir.
						Douglas-fir	182	
Urban land.								
Barnabe.								
134 Inverness	2r	Moderate	Slight	Slight	Severe	Douglas-fir	161	Douglas-fir.
						Bishop pine	---	
135 Inverness	2r	Severe	Slight	Slight	Severe	Douglas-fir	161	Douglas-fir.
						Bishop pine	---	
153*: Palomarin	2o	Slight	Slight	Slight	Severe	Douglas-fir	165	Douglas-fir.
						California-laurel	---	
						Tanoak	---	
Wittenberg	2o	Slight	Moderate	Slight	Moderate	Douglas-fir	165	Douglas-fir.
						Tanoak	---	
						California-laurel	---	
154*: Palomarin	2o	Slight	Slight	Slight	Severe	Douglas-fir	165	Douglas-fir.
						California-laurel	---	
						Tanoak	---	

See footnote at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
154*:								
Wittenberg	2o	Slight	Moderate	Slight	Moderate	Douglas-fir Tanoak California-laurel	165 --- ---	Douglas-fir.
155*:								
Palomarin	2r	Moderate	Slight	Slight	Severe	Douglas-fir California-laurel Tanoak	165 --- ---	Douglas-fir.
Wittenberg	2r	Moderate	Moderate	Slight	Moderate	Douglas-fir Tanoak California-laurel	165 --- ---	Douglas-fir.
156*:								
Palomarin	2r	Severe	Slight	Slight	Severe	Douglas-fir California-laurel Tanoak	165 --- ---	Douglas-fir.
Wittenberg	2r	Severe	Moderate	Slight	Moderate	Douglas-fir Tanoak California-laurel	165 --- ---	Douglas-fir.
167 Sheridan Variant	---	Slight	Moderate	Slight	Moderate	Bishop pine Tanoak	--- ---	Bishop pine, Monterey pine.
168 Sheridan Variant	---	Moderate	Moderate	Slight	Moderate	Bishop pine Tanoak	--- ---	Bishop pine, Monterey pine.
169 Sheridan Variant	---	Severe	Moderate	Slight	Moderate	Bishop pine Tanoak	--- ---	Bishop pine, Monterey pine.
178*:								
Tocaloma	---	Slight	Moderate	Slight	Moderate	Pacific madrone Tanoak Live oak	--- --- ---	
McMullin	5d	Moderate	Moderate	Moderate	Severe	Pacific madrone Tanoak Live oak	--- --- ---	
179*:								
Tocaloma	---	Moderate	Moderate	Slight	Moderate	Pacific madrone Tanoak Live oak	--- --- ---	
McMullin	5d	Severe	Moderate	Moderate	Severe	Pacific madrone Tanoak Live oak	--- --- ---	
180*:								
Tocaloma	---	Severe	Moderate	Slight	Moderate	Pacific madrone Tanoak Live oak	--- --- ---	
McMullin	5d	Severe	Moderate	Moderate	Severe	Pacific madrone Tanoak Live oak	--- --- ---	
181*:								
Tocaloma	---	Slight	Moderate	Slight	Moderate	Pacific madrone Tanoak Live oak	--- --- ---	
McMullin	5d	Moderate	Moderate	Moderate	Severe	Pacific madrone Tanoak Live oak	--- --- ---	

See footnote at end of table.

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
181*:								
Urban land.								
182*:								
Tocaloma----------	---	Moderate	Moderate	Slight	Moderate	Pacific madrone-----	---	
						Tanoak----------	---	
						Live oak----------	---	
McMullin----------	5d	Severe	Moderate	Moderate	Severe	Pacific madrone-----	---	
						Tanoak----------	---	
						Live oak----------	---	
Urban land.								
183*:								
Tocaloma----------	---	Slight	Moderate	Slight	Moderate	Pacific madrone-----	---	
						Tanoak----------	---	
						Live oak----------	---	
Saurin.								
184*:								
Tocaloma----------	---	Moderate	Moderate	Slight	Moderate	Pacific madrone-----	---	
						Tanoak----------	---	
						Live oak----------	---	
Saurin.								
185*:								
Tocaloma----------	---	Severe	Moderate	Slight	Moderate	Pacific madrone-----	---	
						Tanoak----------	---	
						Live oak----------	---	
Saurin.								

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
110*, 111*, 112*:				
Centissima--------	Favorable	5,000	Redwood----------	20
	Normal	4,000	Cascara buckthorn----------	10
	Unfavorable	3,000	Poison-oak----------	10
			Brackenfern----------	5
			Swordfern----------	5
			Blueberry----------	5
			Wake-robin----------	5
			Blackberry----------	5
			Salal----------	5
			Blueblossom ceanothus----------	5
			Poison-hemlock----------	5
			Hazel----------	5
			Pacific madrone----------	5
			Strawberry----------	5
Barnabe.				
119*, 120*:				
Dipsea----------	Favorable	6,000	Carex----------	15
	Normal	5,000	Fern----------	15
	Unfavorable	3,000	Swordfern----------	10
			Poison-hemlock----------	10
			Ryegrass----------	10
			Blueberry----------	5
			Tanoak----------	5
			Buckthorn----------	5
Barnabe.				
121*:				
Dipsea----------	Favorable	6,000	Carex----------	15
	Normal	5,000	Fern----------	15
	Unfavorable	3,000	Swordfern----------	10
			Poison-hemlock----------	10
			Ryegrass----------	10
			Blueberry----------	5
			Tanoak----------	5
			Buckthorn----------	5
Urban land.				
Barnabe.				
134, 135----------	Favorable	6,000	Pine----------	15
Inverness	Normal	5,000	Oak----------	10
	Unfavorable	3,000	Pacific madrone----------	10
			Common velvetgrass----------	5
			California brome----------	5
			Fescue----------	5
			Western swordfern----------	5
			Rush----------	5
			Monkeyflower----------	5
			Wild oat----------	5
			Ripgut brome----------	5
			Blackberry----------	5
			Huckleberry----------	5
			Salal----------	5
			Tanoak----------	5

See footnote at end of table.

TABLE 6.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
153*, 154*, 155*, 156*:				
Palomarin	Favorable	6,000	Swordfern	10
	Normal	5,000	Brackenfern	10
	Unfavorable	2,000	Wake-robin	10
			Blueberry	10
			Poison-oak	10
			Ryegrass	5
			Gooseberry	5
			Himalayaberry	5
			Hazel	5
			Honeysuckle	5
			Anise	5
Wittenberg	Favorable	6,000	Blueberry	15
	Normal	5,000	Swordfern	10
	Unfavorable	3,000	Poison-oak	10
			Tanoak	10
			Ryegrass	10
			Hazel	5
			California-laurel	5
			Brackenfern	5
			Alder	5
			Live oak	5
			Honeysuckle	5
			Wake-robin	5
167, 168, 169--- Sheridan Variant	Favorable	5,000	Bishop pine	15
	Normal	4,000	California brome	10
	Unfavorable	3,000	Blue wildrye	10
			Common velvetgrass	10
			Coyotebrush	10
			Monkeyflower	5
			Honeysuckle	5
			Salal	5
			Live oak	5
			Western thimbleberry	5
			Perennial ryegrass	5
			Annual bluegrass	5
			Bentgrass	5
			Blueberry	5
178*, 179*, 180*:				
Tocaloma	Favorable	4,000	California-laurel	35
	Normal	3,000	Live oak	10
	Unfavorable	1,800	Poison-oak	10
			Ripgut brome	5
			Blue wildrye	5
			Slender hairgrass	5
			Swordfern	5
			Brackenfern	5
			California brome	5
			California wildrose	5
			Bedstraw	5
			Rabbitfootgrass	5
McMullin	Favorable	1,200	California-laurel	15
	Normal	800	Oak	10
	Unfavorable	500	Poison-oak	10
			Blue wildrye	5
			Wild oat	5
			Toyon	5
			Brome	5
			Pacific madrone	5
			Chamise	
			Manzanita	
			Coyotebush	
			Leather oak	
			Bush monkeyflower	
			Purple needlegrass	
			Fescue	

TABLE 6.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
183*, 184*, 185*:				
Tocaloma----------	Favorable	4,000	California-laurel----------	35
	Normal	3,000	California live oak----------	10
	Unfavorable	1,800	Poison-oak----------	10
			Ripgut brome----------	5
			Blue wildrye----------	5
			Slender hairgrass----------	5
			Swordfern----------	5
			Brackenfern----------	5
			California brome----------	5
			California wildrose----------	5
			Bedstraw----------	5
			Rabbitfootgrass----------	5
Saurin.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the text. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
101 Ballard	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: dusty.	Moderate: small stones.
102*: Ballard	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: dusty.	Moderate: small stones.
Urban land.					
103 Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
104*. Beaches					
105*: Blucher	Severe: floods.	Moderate: dusty.	Moderate: slope, floods, dusty.	Severe: erodes easily.	Moderate: floods.
Cole	Severe: floods.	Moderate: wetness.	Moderate: slope, wetness, floods.	Severe: erodes easily.	Moderate: wetness, floods.
106 Bonnydoon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
107 Bonnydoon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
108*: Bonnydoon Variant	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Gilroy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Gilroy Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
109*: Bressa Variant	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
McMullin Variant	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
110*: Centissima	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
110*:					
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: small stones, slope, thin layer.
111*, 112*:					
Centissima	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
113 Clear Lake	Severe: floods.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
114 Cortina	Severe: floods.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, large stones.
115*:					
Cronkhite	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Barnabe	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Slight	Severe: small stones, thin layer.
116*:					
Cronkhite	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: small stones, slope, thin layer.
117*, 118*:					
Cronkhite	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
119*, 120*:					
Dipsea	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
121*:					
Dipsea	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
Urban land.					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
121*: Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
122*. Dune land					
123*: Felton Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Soulajule	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
124*: Felton Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Soulajule	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
125*, 126*: Felton Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Soulajule	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
127*. Fluvents					
128*: Gilroy	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Gilroy Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bonnydoon Variant	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
129 Henneke	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: small stones, large stones, slope.
130*. Humaquepts					
131*. Hydraquents					
132 Inverness	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
133 Inverness	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
134, 135 Inverness	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
136--- Kehoe	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
137--- Kehoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
138--- Kehoe Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope.
139--- Kehoe Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
140*: Los Osos---	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
Bonnydoon---	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight---	Severe: thin layer.
141*: Los Osos---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
142*: Los Osos---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
143*: Los Osos---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Urban land.					
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
144*: Los Osos---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Urban land.					
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
145*: Maymen	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Maymen Variant	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
146--- Montara	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
147--- Novato	Severe: floods, ponding, too clayey.	Severe: ponding, too clayey, excess salt.	Severe: too clayey, ponding, floods.	Severe: ponding, too clayey.	Severe: excess salt, ponding, droughty.
148--- Olompali	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
149--- Olompali	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
150--- Olompali	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: erodes easily.	Severe: slope.
151*, 152*: Pablo	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Bayview	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
153*: Palomarin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Wittenberg	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
154*: Palomarin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Wittenberg	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
155*, 156*: Palomarin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wittenberg	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
157*. Pits					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
158--- Reyes	Severe: floods, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: droughty, too clayey.
159*: Rock outcrop.					
Xerorthents.					
160--- Rodeo	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
161*: Saurin---	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope, thin layer.
Bonnydoon---	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight---	Severe: thin layer.
162*: Saurin---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
163*, 164*: Saurin---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
165*: Saurin---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Urban land.					
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
166*: Saurin---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land.					
Bonnydoon---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
167--- Sheridan Variant	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
168, 169--- Sheridan Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
170--- Sirdrak	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: too sandy, soil blowing.	Moderate: droughty, slope, too sandy.
171--- Sirdrak	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: too sandy, slope, soil blowing.	Severe: slope.
172--- Sirdrak Variant	Severe: percs slowly, too sandy.	Severe: too sandy, percs slowly.	Severe: too sandy, percs slowly.	Severe: too sandy.	Moderate: droughty, thin layer, too sandy.
173--- Sobega	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight---	Moderate: slope, thin layer.
174--- Sobega	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
175*: Tamalpais---	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
Barnabe Variant---	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: small stones, slope, thin layer.
176*, 177*: Tamalpais---	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Barnabe Variant---	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, thin layer.
178*: Tocaloma---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
McMullin---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope, dusty.	Severe: slope, thin layer.
179*, 180*: Tocaloma---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McMullin---	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
181*: Tocaloma---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
181*:					
McMullin	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope, dusty.	Severe: slope, thin layer.
Urban land.					
182*:					
Tocaloma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McMullin	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Urban land.					
183*:					
Tocaloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
Saurin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
184*, 185*:					
Tocaloma	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Saurin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
186 Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
187 Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Moderate: slope.
188 Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope.
189 Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
190 Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
191 Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Moderate: slope.
192 Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope.
193 Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
194*:					
Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
194*:					
Sobega	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
195*:					
Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Moderate: slope.
Sobega	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
196*:					
Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope.
Sobega	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
197*:					
Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
198*:					
Tomales	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Moderate: slope.
Steinbeck	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Slight	Moderate: slope.
199*:					
Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Moderate: slope.	Severe: slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
200*:					
Tomales	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
201*:					
Urban land.					
Ballard	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: dusty.	Moderate: small stones.
202*:					
Urban land.					
Xerorthents.					
203*.					
Xerorthents					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
204*: Xerorthents. Urban land.					
205---------- Yorkville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
206---------- Yorkville	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
207---------- Yorkville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
208*: Yorkville---------- Rock outcrop.	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
209*: Yorkville---------- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
101---------- Ballard	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
102*: Ballard----------	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Urban land.												
103---------- Barnabe	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
104*. Beaches												
105*: Blucher----------	Good	Good	Good	---	---	Good	Fair	Fair	Good	---	Fair	Good.
Cole----------	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
106---------- Bonnydoon	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
107---------- Bonnydoon	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
108*: Bonnydoon Variant-	---	---	Good	---	---	Fair	---	---	---	---	---	Fair.
Gilroy----------	Very poor.	Poor	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Gilroy Variant----	---	---	Good	---	---	Good	---	---	---	---	---	Good.
109*: Bressa Variant----	Poor	Poor	Good	Good	---	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
McMullin Variant--	Poor	Poor	Good	Good	---	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
110*, 111*: Centissima--------	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Barnabe----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
112*: Centissima--------	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Barnabe----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
113---------- Clear Lake	Fair	Good	Fair	---	---	Poor	Very poor.	Very poor.	Good	---	Very poor.	Fair.
114---------- Cortina	Fair	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
115*, 116*:												
Cronkhite	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Barnabe	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
117*:												
Cronkhite	Very poor.	Poor	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Barnabe	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
118*:												
Cronkhite	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Barnabe	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
119*:												
Dipsea	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Barnabe	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
120*:												
Dipsea	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Barnabe	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
121*:												
Dipsea	Very poor.	Very poor.	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Urban land.												
Barnabe	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
122*. Dune land												
123*, 124*:												
Felton Variant	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Soulajule	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
125*:												
Felton Variant	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Soulajule	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
126*:												
Felton Variant	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Soulajule	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
127*. Fluvents												
128*: Gilroy	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Gilroy Variant	---	---	Good	---	---	Good	---	---	---	---	---	Good.
Bonnydoon Variant	---	---	Good	---	---	Fair	---	---	---	---	---	Fair.
129--- Henneke	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
130*. Humaquepts												
131*. Hydraquents												
132, 133--- Inverness	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
134--- Inverness	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
135--- Inverness	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
136--- Kehoe	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
137--- Kehoe	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
138--- Kehoe Variant	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
139--- Kehoe Variant	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
140*: Los Osos	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Bonnydoon	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
141*: Los Osos	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Bonnydoon	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
142*: Los Osos	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Bonnydoon	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
143*: Los Osos	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Urban land.												

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
143*: Bonnydoon	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
144*: Los Osos	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Urban land.												
Bonnydoon	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
145*: Maymen	Very poor.	Very poor.	Poor	---	---	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	---
Maymen Variant	Very poor.	Very poor.	Poor	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
146--- Montara	Very poor.	Very poor.	Poor	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
147--- Novato	---	---	---	---	---	---	Fair	Good	---	---	Fair	---
148, 149, 150--- Olompali	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
151*: Pablo	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Bayview	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
152*: Pablo	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Bayview	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
153*, 154*: Palomarin	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Wittenberg	---	---	Good	Good	Good	Good	Very poor.	Very poor.	---	Good	Very poor.	---
155*, 156*: Palomarin	---	---	Good	Good	Good	Good	Very poor.	Very poor.	---	Good	Very poor.	---
Wittenberg	---	---	Good	Good	Good	Good	Very poor.	Very poor.	---	Good	Very poor.	---
157*. Pits												
158--- Reyes	Fair	Fair	Fair	---	---	Poor	Fair	Good	Fair	---	Fair	Poor.
159*: Rock outcrop.												
Xerorthents.												

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
160---------- Rodeo	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
161*, 162*: Saurin----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Bonnydoon----------	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
163*, 164*: Saurin----------	---	---	Good	---	---	Good	Very poor.	Very poor.	---	---	Very poor.	Good.
Bonnydoon----------	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
165*: Saurin----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Urban land.												
Bonnydoon----------	Poor	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
166*: Saurin----------	---	---	Good	---	---	Good	Very poor.	Very poor.	---	---	Very poor.	Good.
Urban land.												
Bonnydoon----------	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
167---------- Sheridan Variant	Fair	Fair	Good	---	Poor	Good	Very poor.	Very poor.	Fair	Poor	Very poor.	Good.
168---------- Sheridan Variant	Poor	Fair	Good	---	Poor	Good	Very poor.	Very poor.	Fair	Poor	Very poor.	Good.
169---------- Sheridan Variant	Very poor.	Very poor.	Good	---	Poor	Good	Very poor.	Very poor.	Poor	Poor	Very poor.	Good.
170---------- Sirdrak	Fair	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
171---------- Sirdrak	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
172---------- Sirdrak Variant	Fair	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
173, 174---------- Sobega	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
175*: Tamalpais----------	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Barnabe Variant---	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
176*: Tamalpais----------	Poor	Poor	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
176*:												
Barnabe Variant---	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
177*:												
Tamalpais----------	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Barnabe Variant---	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
178*:												
Tocaloma----------	Fair	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
McMullin----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
179*, 180*:												
Tocaloma----------	---	---	Good	Good	Fair	Good	Very poor.	Very poor.	---	Good	Very poor.	---
McMullin----------	Very poor.	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
181*:												
Tocaloma----------	Fair	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
McMullin----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Urban land.												
182*:												
Tocaloma----------	---	---	Good	Good	Fair	Good	Very poor.	Very poor.	---	Good	Very poor.	---
McMullin----------	Very poor.	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Urban land.												
183*:												
Tocaloma----------	Fair	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Saurin------------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
184*, 185*:												
Tocaloma----------	---	---	Good	Good	Fair	Good	Very poor.	Very poor.	---	Good	Very poor.	---
Saurin------------	---	---	Good	---	---	Good	Very poor.	Very poor.	---	---	Very poor.	Good.
186, 187---------- Tomales	Good	Good	Good	---	---	Good	Poor	Poor	Good	---	Poor	Good.
188, 189---------- Tomales	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
190, 191---------- Tomales	Good	Good	Good	---	---	Good	Poor	Poor	Good	---	Poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT-Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
192, 193---------- Tomales	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
194*: Tomales----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Sobega----------	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
195*: Tomales----------	Good	Good	Good	---	---	Good	Poor	Poor	Good	---	Poor	Good.
Sobega----------	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
196*: Tomales----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Sobega----------	Fair	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
197*: Tomales----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Steinbeck---------	---	---	Good	---	---	Good	Very poor.	Very poor.	---	---	Very poor.	Good.
198*: Tomales----------	Good	Good	Good	---	---	Good	Poor	Poor	Good	---	Poor	Good.
Steinbeck---------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
199*: Tomales----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Steinbeck---------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
200*: Tomales----------	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Steinbeck---------	---	---	Good	---	---	Good	Very poor.	Very poor.	---	---	Very poor.	Good.
201*: Urban land.												
Ballard----------	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
202*: Urban land.												
Xerorthents.												
203*. Xerorthents												
204*: Xerorthents.												

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
204*: Urban land.												
205, 206---------- Yorkville	Fair	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
207---------- Yorkville	Very poor.	Poor	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
208*, 209*: Yorkville----------	Fair	Fair	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Rock outcrop.												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the text. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
101--- Ballard	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Moderate: small stones.
102*: Ballard---	Severe: cutbanks cave.	Slight---	Slight---	Moderate: slope.	Slight---	Moderate: small stones.
Urban land.						
103--- Barnabe	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
104*. Beaches						
105*: Blucher---	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Moderate: floods.
Cole---	Severe: wetness.	Severe: floods, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Moderate: wetness, floods.
106, 107--- Bonnydoon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
108*: Bonnydoon Variant	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Gilroy---	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilroy Variant---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
109*: Bressa Variant---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McMullin Variant-	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
110*, 111*, 112*: Centissima---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Barnabe---	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
113--- Clear Lake	Severe: cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
114---------- Cortina	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: small stones, large stones.
115*: Cronkhite--------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Barnabe----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: small stones, thin layer.
116*, 117*, 118*: Cronkhite--------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Barnabe----------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
119*, 120*: Dipsea----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Barnabe----------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
121*: Dipsea----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Urban land.						
Barnabe----------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
122*. Dune land						
123*: Felton Variant---	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Soulajule--------	Moderate: depth to rock, slope, too clayey.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
124*, 125*, 126*: Felton Variant---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Soulajule--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
127*. Fluvents						

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
128*: Gilroy	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gilroy Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bonnydoon Variant	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
129 Henneke	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: small stones, large stones, slope.
130*. Humaquepts						
131*. Hydraquents						
132 Inverness	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope.
133, 134, 135 Inverness	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
136 Kehoe	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
137 Kehoe	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
138 Kehoe Variant	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
139 Kehoe Variant	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
140*: Los Osos	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
Bonnydoon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.
141*, 142*: Los Osos	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Bonnydoon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
143*, 144*: Los Osos	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
143*, 144*: Urban land.						
Bonnydoon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
145*: Maymen	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Maymen Variant	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
146 Montara	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
147 Novato	Severe: ponding.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: low strength, ponding, floods.	Severe: excess salt, ponding, droughty.
148 Olompali	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
149 Olompali	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: wetness, slope.
150 Olompali	Severe: wetness, slope.	Severe: wetness, shrink-swell, slope.	Severe: wetness, slope, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
151*, 152*: Pablo	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Bayview	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
153*: Palomarin	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Wittenberg	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Severe: small stones.
154*, 155*, 156*: Palomarin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wittenberg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
157*. Pits						

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
158---------- Reyes	Moderate: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.	Severe: droughty, too clayey.
159*: Rock outcrop.						
Xerorthents.						
160---------- Rodeo	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
161*: Saurin----------	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, thin layer.
Bonnydoon--------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.
162*, 163*, 164*: Saurin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bonnydoon--------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
165*, 166*: Saurin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Urban land.						
Bonnydoon--------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
167, 168, 169----- Sheridan Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
170---------- Sirdrak	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
171---------- Sirdrak	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
172---------- Sirdrak Variant	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, thin layer, too sandy.
173---------- Sobega	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
174---------- Sobega	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
175*, 176*, 177*: Tamalpais--------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
175*, 176*, 177*: Barnabe Variant--	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
178*, 179*, 180*: Tocaloma---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McMullin---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
181*, 182*: Tocaloma---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McMullin---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Urban land.						
183*, 184*, 185*: Tocaloma---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Saurin----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
186---------- Tomales	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
187---------- Tomales	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
188, 189---------- Tomales	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
190---------- Tomales	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
191---------- Tomales	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
192, 193---------- Tomales	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
194*: Tomales----------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Sobega----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
195*: Tomales----------	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
195*: Sobega	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
196*: Tomales	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Sobega	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
197*: Tomales	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
198*: Tomales	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Steinbeck	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
199*, 200*: Tomales	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
201*: Urban land.						
Ballard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones.
202*: Urban land.						
Xerorthents.						
203*. Xerorthents						
204*: Xerorthents.						
Urban land.						
205 Yorkville	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
206, 207 Yorkville	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
208*:						
Yorkville	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Rock outcrop.						
209*:						
Yorkville	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Rock outcrop.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the text. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
101---------- Ballard	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Poor: small stones.
102*: Ballard----------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Poor: small stones.
Urban land.					
103---------- Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
104*. Beaches					
105*: Blucher----------	Severe: floods, wetness, percs slowly.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
Cole----------	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey.
106, 107---------- Bonnydoon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
108*: Bonnydoon Variant--	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Gilroy----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Gilroy Variant-----	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
109*: Bressa Variant-----	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
McMullin Variant---	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
110*, 111*, 112*: Centissima	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
113 Clear Lake	Severe: percs slowly.	Severe: floods, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
114 Cortina	Severe: poor filter.	Severe: seepage, floods.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
115*: Cronkhite	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
Barnabe	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
116*, 117*, 118*: Cronkhite	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
119*, 120*: Dipsea	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
121*: Dipsea	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
Urban land.					
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
122*. Dune land					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
123*:					
Felton Variant-----	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Poor: thin layer.
Soulajule----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
124*, 125*, 126*:					
Felton Variant-----	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, thin layer.
Soulajule----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
127*. Fluvents					
128*:					
Gilroy-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Gilroy Variant-----	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
Bonnydoon Variant--	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
129---------- Henneke	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, large stones.
130*. Humaquepts					
131*. Hydraquents					
132---------- Inverness	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, slope.
133, 134, 135------- Inverness	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
136---------- Kehoe	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
137---------- Kehoe	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
138---------- Kehoe Variant	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: area reclaim, slope, thin layer.
139---------- Kehoe Variant	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: slope.
140*: Los Osos----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Bonnydoon----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
141*, 142*: Los Osos----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Bonnydoon----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
143*, 144*: Los Osos----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Urban land.					
Bonnydoon----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
145*: Maymen----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Maymen Variant-----	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
146---------- Montara	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
147---------- Novato	Severe: floods, ponding, percs slowly.	Severe: floods, ponding.	Severe: floods, ponding, too clayey.	Severe: floods, ponding.	Poor: too clayey, hard to pack, ponding.
148---------- Olompali	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
149---------- Olompali	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
150---------- Olompali	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope, too clayey.	Severe: wetness, slope.	Poor: too clayey, hard to pack, slope.
151*, 152*: Pablo----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Bayview----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
153*: Palomarin----------	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, small stones, slope.
Wittenberg----------	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.
154*, 155*, 156*: Palomarin----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Wittenberg----------	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
157*. Pits					
158---------- Reyes	Severe: wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness, too clayey, excess salt.	Severe: wetness.	Poor: too clayey, hard to pack, excess salt.
159*: Rock outcrop.					
Xerorthents.					
160---------- Rodeo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
161*: Saurin----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Bonnydoon----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
162*, 163*, 164*: Saurin----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
162*, 163*, 164*: Bonnydoon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
165*, 166*: Saurin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Urban land.					
Bonnydoon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
167, 168, 169 Sheridan Variant	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
170 Sirdrak	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
171 Sirdrak	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
172 Sirdrak Variant.	Severe: cemented pan, wetness, percs slowly.	Severe: seepage, cemented pan, wetness.	Severe: seepage, too sandy.	Severe: cemented pan, seepage.	Poor: area reclaim, seepage, too sandy.
173 Sobega	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
174 Sobega	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
175*, 176*, 177*: Tamalpais	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Barnabe Variant	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
178*, 179*, 180*: Tocaloma	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
McMullin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
181*, 182*:					
Tocaloma	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
McMullin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Urban land.					
183*, 184*, 185*:					
Tocaloma	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Saurin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
186 Tomales	Severe: percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
187 Tomales	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
188, 189 Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
190 Tomales	Severe: percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
191 Tomales	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
192, 193 Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
194*:					
Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Sobega	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
195*:					
Tomales	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
195*:					
Sobega	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
196*:					
Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Sobega	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
197*:					
Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
198*:					
Tomales	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
Steinbeck	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, slope, thin layer.
199*, 200*:					
Tomales	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Steinbeck	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
201*:					
Urban land.					
Ballard	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Poor: small stones.
202*:					
Urban land.					
Xerorthents.					
203*.					
Xerorthents					
204*:					
Xerorthents.					
Urban land.					
205 Yorkville	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
206, 207---------- Yorkville	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
208*: Yorkville----------	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
Rock outcrop.					
209*: Yorkville----------	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Rock outcrop.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the text. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
101--Ballard	Good	Probable	Probable	Poor: small stones, area reclaim.
102*: Ballard	Good	Probable	Probable	Poor: small stones, area reclaim.
Urban land.				
103--Barnabe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
104*. Beaches				
105*: Blucher	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cole	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
106--Bonnydoon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
107--Bonnydoon	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
108*: Bonnydoon Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Gilroy	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gilroy Variant	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
109*: Bressa Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McMullin Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
110*:				
Centissima	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Barnabe	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
111*, 112*:				
Centissima	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Barnabe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
113 Clear Lake	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
114 Cortina	Good	Probable	Probable	Poor: small stones, area reclaim.
115*:				
Cronkhite	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Barnabe	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
116*:				
Cronkhite	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Barnabe	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
117*, 118*:				
Cronkhite	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Barnabe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
119*, 120*:				
Dipsea	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Barnabe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
121*:				
Dipsea	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Urban land.				
Barnabe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
122*. Dune land				
123*:				
Felton Variant	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Soulajule	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
124*:				
Felton Variant	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Soulajule	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
125*, 126*:				
Felton Variant	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Soulajule	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
127*. Fluvents				
128*:				
Gilroy	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gilroy Variant	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Bonnydoon Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
129 Henneke	Poor: area reclaim, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
130*. Humaquepts				

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
131*. Hydraquents				
132---------- Inverness	Fair: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
133---------- Inverness	Fair: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
134, 135---------- Inverness	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
136---------- Kehoe	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, slope.
137---------- Kehoe	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
138---------- Kehoe Variant	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
139---------- Kehoe Variant	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
140*: Los Osos----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bonnydoon----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
141*: Los Osos----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Bonnydoon----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
142*: Los Osos----------	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Bonnydoon----------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
143*: Los Osos----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Urban land.				

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
143*:				
Bonnydoon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
144*:				
Los Osos	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Urban land.				
Bonnydoon	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
145*:				
Maymen	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Maymen Variant	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
146 Montara	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
147 Novato	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
148, 149 Olompali	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
150 Olompali	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
151*, 152*:				
Pablo	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Bayview	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
153*:				
Palomarin	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Wittenberg	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
154*:				
Palomarin	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wittenberg	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
155*, 156*:				
Palomarin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wittenberg	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
157*. Pits				
158 Reyes	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
159*:				
Rock outcrop.				
Xerorthents.				
160 Rodeo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
161*:				
Saurin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, slope.
Bonnydoon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
162*:				
Saurin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bonnydoon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
163*, 164*:				
Saurin	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bonnydoon	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
165*:				
Saurin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
Bonnydoon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
166*:				
Saurin	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
Bonnydoon	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
167 Sheridan Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
168, 169 Sheridan Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
170 Sirdrak	Good	Probable	Improbable: too sandy.	Poor: too sandy.
171 Sirdrak	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
172 Sirdrak Variant	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
173 Sobega	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
174 Sobega	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
175*:				
Tamalpais	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Barnabe Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
176*, 177*:				
Tamalpais	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Barnabe Variant	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
178*:				
Tocaloma	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McMullin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
179*, 180*:				
Tocaloma	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McMullin	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
181*:				
Tocaloma	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McMullin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Urban land.				
182*:				
Tocaloma	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McMullin	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Urban land.				
183*:				
Tocaloma	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Saurin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
184*, 185*:				
Tocaloma	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Saurin	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
186--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
187--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
188--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
189--- Tomales	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
190--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
191--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
192--- Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
193--- Tomales	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
194*: Tomales---	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sobega---	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
195*: Tomales---	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Sobega---	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
196*: Tomales---	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sobega---	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
197*: Tomales---	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Steinbeck---	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
198*: Tomales---	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
198*:				
Steinbeck	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
199*:				
Tomales	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Steinbeck	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
200*:				
Tomales	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Steinbeck	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
201*:				
Urban land.				
Ballard	Good	Probable	Probable	Poor: small stones, area reclaim.
202*:				
Urban land.				
Xerorthents.				
203*.				
Xerorthents				
204*:				
Xerorthents.				
Urban land.				
205				
Yorkville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
206				
Yorkville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
207				
Yorkville	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
208*:				
Yorkville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Rock outcrop.				
209*:				
Yorkville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Rock outcrop.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the text. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
101---------- Ballard	Moderate: seepage, slope.	Severe: thin layer.	Deep to water----	Favorable--------	Favorable.
102*: Ballard----------	Moderate: seepage, slope.	Severe: thin layer.	Deep to water----	Favorable--------	Favorable.
Urban land.					
103---------- Barnabe	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
104*. Beaches					
105*: Blucher----------	Moderate: seepage, slope.	Moderate: piping, wetness.	Deep to water----	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Cole----------	Moderate: slope.	Severe: wetness.	Percs slowly, floods, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
106, 107---------- Bonnydoon	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
108*: Bonnydoon Variant	Severe: depth to rock, slope.	Severe: thin layer, piping.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
Gilroy----------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Gilroy Variant---	Severe: slope.	Severe: thin layer.	Deep to water----	Slope----------	Slope.
109*: Bressa Variant---	Severe: slope.	Moderate: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
McMullin Variant-	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
110*, 111*, 112*: Centissima-------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
Barnabe----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
113---------- Clear Lake	Slight----------	Moderate: hard to pack.	Deep to water----	Percs slowly-----	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
114---------- Cortina	Severe: seepage.	Severe: seepage.	Deep to water----	Too sandy--------	Droughty.
115*, 116*, 117*, 118*: Cronkhite-------	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Barnabe---------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
119*, 120*: Dipsea----------	Severe: slope.	Moderate: thin layer, seepage.	Deep to water----	Slope----------	Slope, droughty.
Barnabe----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
121*: Dipsea----------	Severe: slope.	Moderate: thin layer, seepage.	Deep to water----	Slope----------	Slope, droughty.
Urban land.					
Barnabe----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
122*. Dune land					
123*, 124*, 125*, 126*: Felton Variant--	Severe: slope.	Severe: piping.	Deep to water----	Slope, erodes easily.	Slope, erodes easily, percs slowly.
Soulajule-------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
127*. Fluvents					
128*: Gilroy----------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Gilroy Variant---	Severe: slope.	Severe: thin layer.	Deep to water----	Slope----------	Slope.
Bonnydoon Variant	Severe: depth to rock, slope.	Severe: thin layer, piping.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
129---------- Henneke	Severe: depth to rock, slope.	Severe: thin layer, large stones.	Deep to water----	Slope, large stones, depth to rock.	Large stones, slope, droughty.
130*. Humaquepts					

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
131*. Hydraquents					
132, 133, 134, 135---------- Inverness	Severe: slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
136, 137---------- Kehoe	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
138, 139---------- Kehoe Variant	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
140*, 141*, 142*: Los Osos---------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Bonnydoon--------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
143*, 144*: Los Osos---------	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Urban land.					
Bonnydoon--------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
145*: Maymen----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, droughty, depth to rock.
Maymen Variant---	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water----	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
146---------- Montara	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
147---------- Novato	Slight----------	Severe: hard to pack, ponding, excess salt.	Ponding, percs slowly, floods.	Ponding, percs slowly.	Wetness, excess salt, droughty.
148---------- Olompali	Moderate: slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
149, 150---------- Olompali	Severe: slope.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
151*, 152*: Pablo----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
151*, 152*: Bayview	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
153*, 154*, 155*, 156*: Palomarin	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Wittenberg	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope	Slope, droughty.
157*. Pits					
158 Reyes	Slight	Severe: hard to pack, excess salt.	Deep to water	Percs slowly	Excess salt, droughty, percs slowly.
159*: Rock outcrop.					
Xerorthents.					
160 Rodeo	Moderate: slope.	Severe: wetness.	Percs slowly, slope.	Percs slowly, wetness.	Percs slowly.
161*, 162*, 163*, 164*: Saurin	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Bonnydoon	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
165*, 166*: Saurin	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Urban land.					
Bonnydoon	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
167, 168, 169 Sheridan Variant	Severe: seepage, slope.	Moderate: seepage, thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
170, 171 Sirdrak	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
172 Sirdrak Variant	Severe: seepage.	Severe: seepage, piping.	Percs slowly, cemented pan.	Cemented pan, wetness, too sandy.	Droughty, cemented pan, percs slowly.
173, 174 Sobega	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
175*, 176*, 177*: Tamalpais	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Barnabe Variant	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
178*, 179*, 180*: Tocaloma	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
McMullin	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
181*, 182*: Tocaloma	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
McMullin	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Urban land.					
183*, 184*, 185*: Tocaloma	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, droughty, depth to rock.
Saurin	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
186 Tomales	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
187, 188, 189 Tomales	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
190 Tomales	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
191, 192, 193 Tomales	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
194*, 195*, 196*: Tomales	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Sobega	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes and levees	Drainage	Terraces and diversions	Grassed waterways
197*, 198*, 199*, 200*:					
Tomales	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Steinbeck	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope.
201*:					
Urban land.					
Ballard	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Favorable	Favorable.
202*:					
Urban land.					
Xerorthents.					
203*.					
Xerorthents					
204*:					
Xerorthents.					
Urban land.					
205, 206, 207--- Yorkville	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Slope, percs slowly.
208*, 209*:					
Yorkville	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Slope, percs slowly.
Rock outcrop.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
101---------- Ballard	0-19	Gravelly loam----	SM-SC	A-4	0	60-80	55-75	50-65	35-50	20-30	5-10
	19-65	Gravelly clay loam.	SM-SC, GM-GC	A-4, A-2	0-5	55-80	50-75	40-65	30-50	20-30	5-10
102*:											
Ballard----------	0-19	Gravelly loam----	SM-SC	A-4	0	60-80	55-75	50-65	35-50	20-30	5-10
	19-65	Gravelly clay loam.	SM-SC, GM-GC	A-4, A-2	0-5	55-80	50-75	40-65	30-50	20-30	5-10
Urban land.											
103---------- Barnabe	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
104*. Beaches											
105*:											
Blucher----------	0-7	Silt loam--------	ML	A-4	0	100	100	85-100	50-80	25-35	NP-10
	7-23	Loam, silt loam, fine sandy loam.	ML	A-4	0	100	100	85-100	50-80	25-35	NP-10
	23-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-20
Cole----------	0-5	Clay loam--------	CL	A-6	0	100	95-100	90-100	65-85	30-40	10-20
	5-14	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-25
	14-60	Silty clay loam, clay loam, silty clay.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-25
106, 107---------- Bonnydoon	0-15	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
108*: Bonnydoon Variant--------	0-18	Loam----------	ML	A-4	0	85-100	80-95	75-90	50-70	25-35	NP-10
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilroy----------	0-12	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	80-100	70-90	50-85	20-35	5-15
	12-21	Clay loam, loam	CL	A-6	0	90-100	80-100	75-90	70-85	30-40	10-20
	21-30	Gravelly clay loam, gravelly loam.	SC, CL	A-6	0-5	75-90	50-75	45-70	40-55	30-40	10-20
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilroy Variant--	0-21	Loam----------	ML	A-4	0	80-100	75-95	70-95	50-70	25-35	NP-10
	21-45	Gravelly clay loam.	SC, GC	A-6	0-10	60-80	55-75	50-70	35-50	30-40	10-20
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
109*: Bressa Variant--	0-4	Gravelly loam----	GM-GC, GM, SM-SC, SM	A-4	0-5	55-80	50-75	45-65	35-50	25-35	5-10
	4-25	Gravelly sandy clay loam.	GC, SC	A-6	0-5	55-80	50-75	45-70	35-50	25-35	10-15
	25-30	Sandy clay loam, gravelly sandy clay loam.	GC, SC	A-6	0-5	55-95	50-85	45-75	35-50	30-40	10-20
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
109*:											
McMullin Variant	0-14	Gravelly sandy clay loam.	SC, GC	A-6	0-5	55-80	50-75	45-65	35-50	30-40	10-20
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
110*, 111*, 112*:											
Centissima------	0-15	Loam----------	ML, CL-ML	A-4	0	95-100	75-90	60-80	50-65	20-30	NP-10
	15-22	Loam, gravelly loam.	CL-ML, SM-SC, GM-GC	A-4	0	70-95	60-90	50-80	40-65	25-30	5-10
	22-33	Very gravelly clay loam, gravelly clay loam, gravelly loam.	GC, SC	A-2	0	45-80	35-70	20-45	20-35	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe---------	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
113---------------	0-28	Clay----------	CH, CL	A-7	0	100	100	95-100	85-95	40-70	20-40
Clear Lake	28-60	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-70	20-40
114---------------	0-10	Gravelly sandy loam.	SM, GM	A-2, A-4	0-10	55-85	50-75	35-60	25-40	20-30	NP-5
Cortina	10-44	Stratified very gravelly loamy sand to very gravelly loam.	GM, GP-GM	A-1, A-2	0-10	30-60	25-55	15-40	5-35	20-30	NP-5
	44-60	Stratified very gravelly sand to very gravelly loamy sand.	GP, SP, SP-SM, GP-GM	A-1	0-10	30-60	25-55	15-45	0-10	---	NP
115*, 116*, 117*, 118*:											
Cronkhite------	0-15	Loam----------	ML	A-4	0	100	95-100	85-95	60-75	25-35	NP-10
	15-26	Clay loam--------	CL	A-6	0	100	95-100	90-100	70-80	30-40	10-20
	26-45	Clay, clay loam	CL, CH	A-7	0	100	95-100	90-100	70-95	40-55	15-30
	45-55	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe---------	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
119*, 120*:											
Dipsea----------	0-8	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	20-35	25-35	5-10
	8-25	Very gravelly clay loam, very gravelly loam.	GC	A-2	0	50-60	30-50	25-50	25-35	30-40	10-20
	25-48	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	25-35	25-35	5-10
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
Barnabe---------	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
121*:											
Dipsea	0-8	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	20-35	25-35	5-10
	8-25	Very gravelly clay loam, very gravelly loam.	GC	A-2	0	50-60	30-50	25-50	25-35	30-40	10-20
	25-48	Very gravelly loam.	GM, GM-GC	A-2	0	50-60	30-50	25-50	25-35	25-35	5-10
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Barnabe	0-8	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	8-16	Very gravelly loam.	GM-GC, GM	A-2	0	45-55	35-50	30-45	25-30	25-35	5-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
122*. Dune land											
123*, 124*, 125*, 126*:											
Felton Variant	0-23	Loam	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	23-34	Clay loam	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
	34-47	Clay	CL, CH	A-7	0	100	100	90-100	75-95	45-55	20-30
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
Soulajule	0-17	Clay loam	CL	A-6	0	90-100	75-100	70-95	65-80	30-40	10-20
	17-22	Gravelly clay, gravelly clay loam.	CL, CH, GC	A-7	0	60-75	50-65	50-65	45-60	40-55	20-30
	22-28	Very gravelly clay, very gravelly clay loam.	GC	A-2, A-7	0	30-60	25-50	25-50	20-40	40-55	20-30
	28	Weathered bedrock	---	---	---	---	---	---	---	---	---
127*. Fluvents											
128*:											
Gilroy	0-12	Loam	CL-ML, CL	A-4, A-6	0	95-100	80-100	70-90	50-85	20-35	5-15
	12-21	Clay loam, loam	CL	A-6	0	90-100	80-100	75-90	70-85	30-40	10-20
	21-30	Gravelly clay loam, gravelly loam.	SC, CL	A-6	0-5	75-90	50-75	45-70	40-55	30-40	10-20
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilroy Variant	0-21	Loam	ML	A-4	0	80-100	75-95	70-95	50-70	25-35	NP-10
	21-45	Gravelly clay loam.	SC, GC	A-6	0-10	60-80	55-75	50-70	35-50	30-40	10-20
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bonnydoon Variant	0-18	Loam	ML	A-4	0	85-100	80-95	75-90	50-70	25-35	NP-10
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
129 Henneke	0-3	Stony clay loam	GC	A-2	30-70	40-50	35-45	30-40	25-35	40-60	15-35
	3-16	Very cobbly clay, very cobbly clay loam.	GC	A-2	30-50	55-65	50-60	30-40	25-35	40-60	15-35
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
130*. Humaquepts											
131*. Hydraquents											
132, 133, 134, 135----------	0-22	Loam----------	ML	A-4	0	100	95-100	60-80	50-60	30-40	5-10
Inverness	22-36	Clay loam, loam	ML	A-5, A-7	0	100	95-100	85-95	60-75	40-50	5-15
	36-60	Loam, sandy loam	ML, SM	A-4	0	100	95-100	50-80	35-60	25-40	NP-10
	60	Weathered bedrock	---	---	---	---	---	---	---	---	---
136, 137---------	0-34	Loam----------	ML	A-4	0	100	95-100	60-80	50-70	25-35	NP-10
Kehoe	34-38	Fine sandy loam, sandy loam, loam.	ML	A-4	0	100	95-100	55-80	50-70	25-35	NP-10
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
138, 139---------	0-41	Coarse sandy loam	SM	A-2	0	95-100	85-95	50-60	25-35	---	NP
Kehoe Variant	41-49	Loamy coarse sand	SM	A-1, A-2	0	95-100	85-95	40-50	20-30	---	NP
	49	Weathered bedrock	---	---	---	---	---	---	---	---	---
140*:											
Los Osos--------	0-18	Loam----------	ML, CL-ML	A-4	0	95-100	90-100	70-100	60-95	25-35	5-10
	18-38	Silty clay, clay loam, clay.	CL, CH	A-7	0	95-100	90-100	75-100	55-90	45-60	20-30
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bonnydoon-------	0-15	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
141*:											
Los Osos--------	0-18	Loam----------	ML, CL-ML	A-4	0	95-100	90-100	70-100	60-95	25-35	5-10
	18-38	Silty clay, clay loam, clay.	CL, CH	A-7	0	95-100	90-100	75-100	55-90	45-60	20-30
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bonnydoon-------	0-15	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
142*:											
Los Osos--------	0-15	Loam----------	ML, CL-ML	A-4	0	95-100	90-100	70-100	60-95	25-35	5-10
	15-30	Silty clay, clay loam, clay.	CL, CH	A-7	0	95-100	90-100	75-100	55-90	45-60	20-30
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bonnydoon-------	0-11	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
143*:											
Los Osos--------	0-18	Loam----------	ML, CL-ML	A-4	0	95-100	90-100	70-100	60-95	25-35	5-10
	18-38	Silty clay, clay loam, clay.	CL, CH	A-7	0	95-100	90-100	75-100	55-90	45-60	20-30
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Bonnydoon-------	0-15	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
144*:											
Los Osos--------	0-15	Loam----------	ML, CL-ML	A-4	0	95-100	90-100	70-100	60-95	25-35	5-10
	15-30	Silty clay, clay loam, clay.	CL, CH	A-7	0	95-100	90-100	75-100	55-90	45-60	20-30
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
144*: Urban land.											
Bonnydoon	0-11	Gravelly loam	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
145*:											
Maymen	0-12	Gravelly loam	SM, GM	A-2, A-4	0-5	60-80	50-75	30-60	25-50	20-35	NP-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Maymen Variant	0-4	Gravelly loam	SM, GM	A-4	0-5	55-80	50-75	45-70	35-50	25-35	NP-10
	4-37	Gravelly clay	GC, CH	A-7	0	60-80	55-75	45-70	45-60	50-65	25-35
	37	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
146 Montara	0-13	Clay loam	CL	A-6, A-7	0-5	90-100	75-95	75-90	70-80	30-45	10-20
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
147 Novato	0-15	Clay	MH	A-7	0	100	100	90-100	80-95	50-70	20-30
	15-60	Clay, silty clay, silty clay loam.	MH	A-7	0	100	100	85-100	85-95	50-70	15-30
148, 149, 150 Olompali	0-13	Loam	ML	A-4	0	100	100	85-95	60-75	20-35	NP-10
	13-28	Clay	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	28-42	Gravelly clay	GC, CL, CH	A-7	0	65-80	55-75	50-70	45-65	40-60	20-35
	42-60	Clay	CL, CH	A-7	0	95-100	95-100	90-100	75-95	40-60	20-35
	60	Weathered bedrock	---	---	---	---	---	---	---	---	---
151*, 152*:											
Pablo	0-15	Loam	ML	A-4	0	85-100	75-100	60-75	50-60	25-35	NP-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bayview	0-7	Very gravelly loam.	GM-GC, GM	A-2, A-4	0	40-60	35-50	30-50	25-40	25-35	5-10
	7-14	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-2, A-4, A-6	0	40-60	35-50	30-50	25-40	25-40	5-15
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
153*, 154*, 155*, 156*:											
Palomarin	0-18	Loam	ML	A-4	0	85-100	75-100	70-90	50-70	25-35	NP-10
	18-41	Loam, gravelly loam.	CL-ML, ML SM-SC, GM-GC	A-4	0	65-100	60-100	50-90	35-70	25-35	5-10
	41	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wittenberg	0-26	Very gravelly loam.	GM-GC, GM	A-2	0	30-60	25-50	20-45	15-35	25-35	5-10
	26-50	Very gravelly loam.	GM-GC, GM	A-2	0	30-60	25-50	20-45	15-35	25-35	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
157*. Pits											
158 Reyes	0-14	Clay	MH	A-7	0	100	100	90-100	85-95	50-70	20-30
	14-63	Clay, silty clay, silty clay loam.	MH	A-7	0	100	100	85-100	85-95	50-70	15-30
159*: Rock outcrop.											

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
159*: Xerorthents.											
160---------- Rodeo	0-20	Clay loam--------	CL	A-6	0	100	100	90-100	75-85	30-40	10-20
	20-75	Clay loam, clay	CL, CH	A-7	0	100	80-100	80-100	75-95	40-60	20-35
161*, 162*: Saurin----------	0-10	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-15
	10-33	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bonnydoon-------	0-15	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	15	Weathered bedrock	---	---	---	---	---	---	---	---	---
163*, 164*: Saurin----------	0-10	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-15
	10-33	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bonnydoon-------	0-11	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
165*: Saurin----------	0-10	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-15
	10-33	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Bonnydoon-------	0-11	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
166*: Saurin----------	0-10	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-15
	10-33	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Bonnydoon-------	0-11	Gravelly loam----	GM-GC, GC, SM-SC, SC	A-4, A-6	0-5	60-80	55-75	50-65	35-50	25-40	5-15
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
167, 168, 169---- Sheridan Variant	0-26	Coarse sandy loam	SM	A-1, A-2	0	85-100	75-95	45-60	20-35	---	NP
	26-31	Gravelly sandy loam, coarse sandy loam.	SM	A-1, A-2	0	80-95	70-95	40-60	15-35	---	NP
	31	Weathered bedrock	---	---	---	---	---	---	---	---	---
170, 171--------- Sirdrak	0-16	Sand----------	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
	16-48	Loamy sand, sand	SP-SM, SM	A-2, A-3	0	100	100	50-90	5-30	---	NP
	48-73	Sand----------	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
172---------- Sirdrak Variant	0-38	Sand----------	SM, SP-SM	A-2, A-3	0	100	100	50-90	5-25	---	NP
	38-59	Sand----------	SM, SP-SM	A-1, A-2, A-3	0-5	85-100	75-90	40-65	5-15	---	NP
	59-72	Sand----------	SM, SP-SM	A-2, A-3	0	100	100	50-90	5-25	---	NP
173, 174--------- Sobega	0-17	Loam----------	ML	A-4	0	80-100	75-95	60-80	50-65	25-35	NP-10
	17-22	Sandy loam, loam	SM, ML	A-4	0	80-100	75-95	50-80	35-65	25-35	NP-10
	22	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
175*, 176*, 177*:											
Tamalpais-------	0-19	Very gravelly loam.	GM, GM-GC	A-2, A-4	0-5	40-65	35-50	30-50	25-40	25-35	5-10
	19-39	Very gravelly clay loam.	GC	A-2, A-6	5-10	40-65	40-55	35-50	30-40	30-40	10-20
	39	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Barnabe Variant-	0-13	Very gravelly loam.	GM, GM-GC	A-2, A-4	5-10	40-50	35-50	30-50	25-40	25-35	5-10
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
178*, 179*, 180*:											
Tocaloma--------	0-19	Loam----------	ML, CL-ML	A-4	0	80-100	75-95	65-85	50-70	25-35	5-10
	19-39	Very gravelly loam.	GM-GC, GM	A-2, A-4	0	45-60	35-50	30-50	25-40	25-35	5-10
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
McMullin--------	0-4	Gravelly loam----	SM	A-4, A-2	0-25	70-80	65-75	45-65	25-50	20-30	NP-5
	4-18	Gravelly clay loam, gravelly loam.	CL	A-6	0-25	75-95	65-75	60-75	50-60	30-40	10-15
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
181*, 182*:											
Tocaloma--------	0-19	Loam----------	ML, CL-ML	A-4	0	80-100	75-95	65-85	50-70	25-35	5-10
	19-39	Very gravelly loam.	GM-GC, GM	A-2, A-4	0	45-60	35-50	30-50	25-40	25-35	5-10
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
McMullin--------	0-4	Gravelly loam----	SM	A-4, A-2	0-25	70-80	65-75	45-65	25-50	20-30	NP-5
	4-18	Gravelly clay loam, gravelly loam.	CL	A-6	0-25	75-95	65-75	60-75	50-60	30-40	10-15
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land.											
183*, 184*, 185*:											
Tocaloma--------	0-19	Loam----------	ML, CL-ML	A-4	0	80-100	75-95	65-85	50-70	25-35	5-10
	19-39	Very gravelly loam.	GM-GC, GM	A-2, A-4	0	45-60	35-50	30-50	25-40	25-35	5-10
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
Saurin----------	0-10	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-15
	10-33	Clay loam--------	CL	A-6	0	95-100	75-95	70-90	55-70	30-40	10-20
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
186, 187, 188, 189---------- Tomales	0-12	Fine sandy loam	SM	A-4	0	100	100	60-80	35-50	20-30	NP-5
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
190, 191, 192, 193---------- Tomales	0-12	Loam----------	ML, CL-ML	A-4	0	100	100	70-95	60-70	25-35	5-10
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
194*:											
Tomales---------	0-12	Loam----------	ML, CL-ML	A-4	0	100	100	70-95	60-70	25-35	5-10
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
194*:											
Sobega----------	0-17	Loam----------	ML	A-4	0	80-100	75-95	60-80	50-65	25-35	NP-10
	17-22	Sandy loam, loam	SM, ML	A-4	0	80-100	75-95	50-80	35-65	25-35	NP-10
	22	Weathered bedrock	---	---	---	---	---	---	---	---	---
195*, 196*:											
Tomales---------	0-12	Fine sandy loam	SM	A-4	0	100	100	60-80	35-50	20-30	NP-5
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sobega----------	0-17	Sandy loam-------	SM	A-4	0	80-100	75-95	50-75	35-50	25-30	NP-5
	17-22	Sandy loam, loam	SM, ML	A-4	0	80-100	75-95	50-80	35-65	25-35	NP-10
	22	Weathered bedrock	---	---	---	---	---	---	---	---	---
197*:											
Tomales---------	0-12	Fine sandy loam	SM	A-4	0	100	100	60-80	35-50	20-30	NP-5
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
Steinbeck-------	0-35	Fine sandy loam	ML	A-4	0	100	100	85-95	50-75	25-35	NP-10
	35-48	Loam, clay loam	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
198*, 199*, 200*:											
Tomales---------	0-12	Loam----------	ML, CL-ML	A-4	0	100	100	70-95	60-70	25-35	5-10
	12-24	Loam, silt loam	CL-ML, ML	A-4	0	100	100	70-95	60-80	25-40	5-10
	24-47	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	75-95	40-60	20-35
	47	Weathered bedrock	---	---	---	---	---	---	---	---	---
Steinbeck-------	0-35	Loam----------	ML	A-4	0	100	100	85-95	50-75	25-35	NP-10
	35-48	Loam, clay loam	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
201*:											
Urban land.											
Ballard----------	0-19	Gravelly loam----	SM-SC	A-4	0	60-80	55-75	50-65	35-50	20-30	5-10
	19-65	Gravelly loam----	SM-SC, GM-GC	A-4, A-2	0-5	55-80	50-75	40-65	30-50	20-30	5-10
202*:											
Urban land.											
Xerorthents.											
203*.											
Xerorthents											
204*:											
Xerorthents.											
Urban land.											
205, 206----------	0-14	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-95	70-85	30-45	10-20
Yorkville	14-51	Clay loam, clay	MH, CH	A-7	0	100	100	90-100	75-95	50-60	20-30
	51	Weathered bedrock	---	---	---	---	---	---	---	---	---
207----------	0-10	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-95	70-85	30-45	10-20
Yorkville	10-45	Clay loam, clay	MH, CH	A-7	0	100	100	90-100	75-95	50-60	20-30
	45	Weathered bedrock	---	---	---	---	---	---	---	---	---
208*, 209*:											
Yorkville-------	0-14	Clay loam--------	CL	A-6, A-7	0	100	95-100	90-95	70-85	30-45	10-20
	14-51	Clay loam, clay	MH, CH	A-7	0	100	100	90-100	75-95	50-60	20-30
	51	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
101----------	0-19	10-20	0.6-2.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	8	1-3
Ballard	19-65	18-27	0.6-2.0	0.12-0.15	5.6-6.5	Low----------	0.20			
102*:										
Ballard----------	0-19	10-20	0.6-2.0	0.12-0.15	5.6-6.5	Low----------	0.20	5	8	1-3
	19-65	18-27	0.6-2.0	0.12-0.15	5.6-6.5	Low----------	0.20			
Urban land.										
103----------	0-8	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15	1	8	1-3
Barnabe	8-16	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	16	---	---	---	---	----------	----			
104*.										
Beaches										
105*:										
Blucher----------	0-7	15-25	0.6-2.0	0.15-0.18	5.6-6.5	Low----------	0.37	5	8	2-4
	7-23	15-25	0.6-2.0	0.14-0.18	6.1-8.4	Low----------	0.43			
	23-60	27-40	0.06-0.2	0.17-0.19	7.4-8.4	Moderate-----	0.32			
Cole----------	0-5	27-35	0.2-0.6	0.15-0.18	5.6-7.3	Moderate-----	0.37	5	8	1-4
	5-14	35-45	0.06-0.2	0.12-0.17	6.1-8.4	High---------	0.32			
	14-60	35-45	0.06-0.2	0.12-0.17	6.6-8.4	High---------	0.32			
106, 107---------	0-15	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
Bonnydoon	15	---	---	---	---	----------	----			
108*:										
Bonnydoon Variant--------	0-18	18-25	0.6-2.0	0.15-0.17	6.1-7.3	Low----------	0.32	1	7	1-4
	18	---	---	---	---	----------	----			
Gilroy----------	0-12	20-30	0.6-2.0	0.14-0.18	5.6-7.3	Moderate-----	0.37	2	8	2-6
	12-21	25-35	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.32			
	21-30	25-35	0.2-0.6	0.10-0.15	6.6-8.4	Moderate-----	0.24			
	30	---	---	---	---	----------	----			
Gilroy Variant--	0-21	18-25	0.6-2.0	0.15-0.17	6.1-7.3	Low----------	0.32	3	8	1-4
	21-45	27-35	0.2-0.6	0.11-0.14	6.6-7.3	Moderate-----	0.24			
	45	---	---	---	---	----------	----			
109*:										
Bressa Variant--	0-3	20-25	0.6-2.0	0.10-0.15	5.6-7.3	Low----------	0.20	2	8	<1
	3-25	20-25	0.6-2.0	0.11-0.15	5.1-6.5	Moderate-----	0.20			
	25-30	30-35	0.2-0.6	0.11-0.16	5.6-7.3	Moderate-----	0.24			
	30	---	---	---	---	----------	----			
McMullin Variant	0-14	20-30	0.6-2.0	0.11-0.15	5.1-6.5	Moderate-----	0.20	1	8	1-3
	14	---	---	---	---	----------	----			
110*, 111*, 112*:										
Centissima------	0-15	15-25	0.6-2.0	0.10-0.15	5.6-6.5	Low----------	0.32	3	7	2-4
	15-22	15-25	0.6-2.0	0.09-0.15	5.6-6.5	Low----------	0.20			
	22-33	20-35	0.6-2.0	0.09-0.11	5.6-6.5	Moderate-----	0.15			
	33	---	---	---	---	----------	----			
Barnabe----------	0-8	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15	1	8	1-3
	8-16	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	16	---	---	---	---	----------	----			
113----------	0-28	40-60	0.06-0.2	0.12-0.16	6.1-8.4	High---------	0.24	5	8	1-4
Clear Lake	28-60	40-60	0.06-0.2	0.12-0.16	7.4-8.4	High---------	0.24			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
114----------	0-10	10-25	2.0-6.0	0.07-0.14	5.6-8.4	Low----------	0.20	5	8	<1
Cortina	10-44	5-25	2.0-6.0	0.06-0.08	5.6-8.4	Low----------	0.15			
	44-60	0-15	6.0-20	0.03-0.05	5.6-8.4	Low----------	0.10			
115*, 116*, 117*, 118*:										
Cronkhite------	0-15	20-27	0.6-2.0	0.14-0.16	6.1-7.3	Low----------	0.37	3	8	1-3
	15-26	27-35	0.2-0.6	0.17-0.19	6.1-7.3	Moderate-----	0.32			
	26-45	35-50	0.06-0.2	0.15-0.18	6.1-7.3	High---------	0.17			
	45-55	---	---	---	---	----------	---			
Barnabe--------	0-8	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15	1	8	1-3
	8-16	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	16	---	---	---	---	----------	---			
119*, 120*:										
Dipsea----------	0-8	15-27	0.6-2.0	0.08-0.10	5.6-6.5	Low----------	0.10	3	8	3-12
	8-25	25-35	0.6-2.0	0.09-0.11	5.6-6.5	Low----------	0.10			
	25-48	15-27	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.10			
	48	---	---	---	---	----------	---			
Barnabe---------	0-8	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15	1	8	1-3
	8-16	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	16	---	---	---	---	----------	---			
121*:										
Dipsea----------	0-8	15-27	0.6-2.0	0.08-0.10	5.6-6.5	Low----------	0.10	3	8	3-12
	8-25	25-35	0.6-2.0	0.09-0.11	5.6-6.5	Low----------	0.10			
	25-48	15-27	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.10			
	48	---	---	---	---	----------	---			
Urban land.										
Barnabe---------	0-8	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15	1	8	1-3
	8-16	15-27	0.6-2.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	16	---	---	---	---	----------	---			
122*. Dune land										
123*, 124*, 125*, 126*:										
Felton Variant-	0-23	18-27	0.6-2.0	0.13-0.17	6.1-6.5	Low----------	0.37	2	8	1-3
	23-34	27-35	0.2-0.6	0.17-0.19	6.1-7.3	Moderate-----	0.32			
	34-47	40-50	0.06-0.2	0.14-0.16	6.6-7.3	High---------	0.32			
	47	---	---	---	---	----------	---			
Soulajule------	0-17	27-35	0.2-2.0	0.15-0.18	5.1-6.5	Moderate-----	0.37	3	8	1-2
	17-22	35-50	0.06-0.2	0.08-0.13	4.5-6.5	High---------	0.17			
	22-28	35-50	0.06-0.2	0.05-0.10	4.5-6.5	Moderate-----	0.10			
	28	---	---	---	---	----------	---			
127*. Fluvents										
128*:										
Gilroy----------	0-12	20-30	0.6-2.0	0.14-0.18	5.6-7.3	Moderate-----	0.37	2	8	2-6
	12-21	25-35	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.32			
	21-30	25-35	0.2-0.6	0.10-0.15	6.6-8.4	Moderate-----	0.24			
	30	---	---	---	---	----------	---			
Gilroy Variant--	0-21	18-25	0.6-2.0	0.15-0.17	6.1-7.3	Low----------	0.32	3	8	1-4
	21-45	27-35	0.2-0.6	0.11-0.14	6.6-7.3	Moderate-----	0.24			
	45	---	---	---	---	----------	---			
Bonnydoon Variant--------	0-18	18-25	0.6-2.0	0.15-0.17	6.1-7.3	Low----------	0.32	1	7	1-4
	18	---	---	---	---	----------	---			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
129----------	0-3	27-35	0.2-0.6	0.05-0.07	5.6-8.4	Moderate-----	0.10	1	8	2-7
Henneke	3-16	35-50	0.2-0.6	0.05-0.07	5.6-8.4	Moderate-----	0.15			
	16	---	---	---	---	----------	----			
130*.										
Humaquepts										
131*.										
Hydraquents										
132, 133, 134,										
135----------	0-22	15-25	0.6-2.0	0.14-0.16	5.1-6.0	Low----------	0.28	3	8	2-4
Inverness	22-36	25-35	0.6-2.0	0.14-0.18	5.1-6.0	Moderate-----	0.32			
	36-60	10-25	0.6-2.0	0.10-0.16	5.6-6.0	Low----------	0.32			
	60	---	---	---	---	----------	----			
136, 137---------	0-34	18-25	2.0-6.0	0.15-0.17	5.6-6.5	Low----------	0.37	2	7	1-3
Kehoe	34-38	18-25	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.37			
	38	---	---	---	---	----------	----			
138, 139---------	0-41	8-15	2.0-6.0	0.10-0.12	5.6-6.5	Low----------	0.24	2	5	1-3
Kehoe Variant	41-49	5-10	2.0-6.0	0.06-0.08	5.6-7.3	Low----------	0.15			
	49	---	---	---	---	----------	----			
140*:										
Los Osos---------	0-18	20-27	0.6-2.0	0.14-0.17	5.6-7.3	Moderate-----	0.37	2	8	2-4
	18-38	35-50	0.06-0.2	0.12-0.16	5.6-7.3	High---------	0.28			
	38	---	---	---	---	----------	----			
Bonnydoon--------	0-15	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	15	---	---	---	---	----------	----			
141*:										
Los Osos---------	0-18	20-27	0.6-2.0	0.14-0.17	5.6-7.3	Moderate-----	0.37	2	8	2-4
	18-38	35-50	0.06-0.2	0.12-0.16	5.6-7.3	High---------	0.28			
	38	---	---	---	---	----------	----			
Bonnydoon--------	0-15	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	15	---	---	---	---	----------	----			
142*:										
Los Osos---------	0-15	20-27	0.6-2.0	0.14-0.17	5.6-7.3	Moderate-----	0.37	2	8	2-4
	15-30	35-50	0.06-0.2	0.12-0.16	5.6-7.3	High---------	0.28			
	30	---	---	---	---	----------	----			
Bonnydoon--------	0-11	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	11	---	---	---	---	----------	----			
143*:										
Los Osos---------	0-18	20-27	0.6-2.0	0.14-0.17	5.6-7.3	Moderate-----	0.37	2	8	2-4
	18-38	35-50	0.06-0.2	0.12-0.16	5.6-7.3	High---------	0.28			
	38	---	---	---	---	----------	----			
Urban land.										
Bonnydoon--------	0-15	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	15	---	---	---	---	----------	----			
144*:										
Los Osos---------	0-15	20-27	0.6-2.0	0.14-0.17	5.6-7.3	Moderate-----	0.37	2	8	2-4
	15-30	35-50	0.06-0.2	0.12-0.16	5.6-7.3	High---------	0.28			
	30	---	---	---	---	----------	----			
Urban land.										
Bonnydoon--------	0-11	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	11	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
145*:										
Maymen	0-12	10-25	0.6-2.0	0.08-0.14	4.5-6.5	Low	0.20	1	8	<1
	12	---	---	---	---	---	---			
Maymen Variant	0-4	15-25	0.6-2.0	0.10-0.13	5.6-6.0	Low	0.20	2	8	1-2
	4-37	40-60	0.06-0.2	0.10-0.13	5.6-6.5	High	0.20			
	37	---	---	---	---	---	---			
146	0-13	18-35	0.2-0.6	0.14-0.19	6.6-8.4	Moderate	0.32	1	8	1-3
Montara	13	---	---	---	---	---	---			
147	0-15	40-60	0.06-0.2	0.06-0.10	7.9-9.0	High	0.20	5	8	4-10
Novato	15-60	35-60	0.06-0.2	0.03-0.05	7.9-9.0	High	0.32			
148, 149, 150	0-13	18-25	0.6-2.0	0.15-0.17	5.6-6.5	Low	0.37	3	8	1-3
Olompali	13-28	40-60	<0.06	0.12-0.15	6.1-6.5	High	0.24			
	28-42	40-60	<0.06	0.10-0.12	6.6-7.3	High	0.17			
	42-60	40-60	<0.06	0.12-0.15	6.6-7.3	High	0.24			
	60	---	---	---	---	---	---			
151*, 152*:										
Pablo	0-15	20-27	0.6-2.0	0.13-0.16	5.6-6.5	Low	0.32	1	8	1-3
	15	---	---	---	---	---	---			
Bayview	0-7	20-27	0.6-2.0	0.05-0.07	5.6-6.5	Low	0.15	1	8	1-3
	7-14	20-35	0.6-2.0	0.05-0.07	5.6-6.5	Low	0.15			
	14	---	---	---	---	---	---			
153*, 154*, 155*, 156*:										
Palomarin	0-18	20-27	0.6-2.0	0.15-0.17	4.5-5.5	Low	0.32	3	8	2-6
	18-41	20-27	0.6-2.0	0.11-0.17	4.5-5.5	Low	0.37			
	41	---	---	---	---	---	---			
Wittenberg	0-26	20-27	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10	3	8	1-4
	26-50	20-27	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10			
	50	---	---	---	---	---	---			
157*.										
Pits										
158	0-14	40-60	0.06-0.2	0.06-0.14	3.6-6.5	High	0.20	5	8	2-10
Reyes	14-63	35-60	0.06-0.2	0.03-0.05	3.6-6.0	High	0.32			
159*:										
Rock outcrop.										
Xerorthents.										
160	0-20	27-35	0.2-0.6	0.17-0.19	5.1-6.0	Moderate	0.32	5	8	1-3
Rodeo	20-75	35-50	0.06-0.2	0.13-0.16	4.5-6.0	High	0.20			
161*, 162*:										
Saurin	0-10	27-33	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.32	2	8	1-3
	10-33	30-35	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.37			
	33	---	---	---	---	---	---			
Bonnydoon	0-15	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low	0.20	1	8	1-3
	15	---	---	---	---	---	---			
163*, 164*:										
Saurin	0-10	27-33	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.32	2	8	1-3
	10-33	30-35	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.37			
	33	---	---	---	---	---	---			
Bonnydoon	0-11	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low	0.20	1	8	1-3
	11	---	---	---	---	---	---			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
165*:										
Saurin----------	0-10	27-33	0.6-2.0	0.16-0.19	5.6-6.5	Moderate-----	0.32	2	8	1-3
	10-33	30-35	0.6-2.0	0.16-0.19	5.6-6.5	Moderate-----	0.37			
	33	---	---	---	---	----------	----			
Urban land.										
Bonnydoon-------	0-11	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	11	---	---	---	---	----------	----			
166*:										
Saurin----------	0-10	27-33	0.6-2.0	0.16-0.19	5.6-6.5	Moderate-----	0.32	2	8	1-3
	10-33	30-35	0.6-2.0	0.16-0.19	5.6-6.5	Moderate-----	0.37			
	33	---	---	---	---	----------	----			
Urban land.										
Bonnydoon-------	0-11	18-30	0.6-2.0	0.11-0.14	5.6-7.3	Low----------	0.20	1	8	1-3
	11	---	---	---	---	----------	----			
167, 168, 169----	0-26	5-15	2.0-6.0	0.08-0.12	5.6-6.5	Low----------	0.24	2	8	2-10
Sheridan Variant	26-31	5-15	2.0-6.0	0.07-0.10	5.6-6.5	Low----------	0.24			
	31	---	---	---	---	----------	----			
170, 171---------	0-16	0-5	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.15	5	1	1-5
Sirdrak	16-48	0-5	6.0-20	0.07-0.10	5.1-6.5	Low----------	0.15			
	48-73	0-5	6.0-20	0.05-0.07	5.1-6.5	Low----------	0.15			
172----------	0-38	0-5	6.0-20	0.07-0.10	5.1-6.5	Low----------	0.15	5	1	2-5
Sirdrak Variant	38-59	0-5	<0.06	0.06-0.09	5.1-6.5	Low----------	0.15			
	59-72	0-5	6.0-20	0.07-0.10	5.1-6.5	Low----------	0.15			
173, 174---------	0-17	18-25	0.6-2.0	0.13-0.16	4.5-6.0	Low----------	0.32	2	8	1-4
Sobega	17-22	18-27	0.6-2.0	0.11-0.15	5.1-6.0	Low----------	0.37			
	22	---	---	---	---	----------	----			
175*, 176*, 177*:										
Tamalpais-------	0-19	20-25	0.6-2.0	0.08-0.10	5.6-6.5	Low----------	0.15	3	8	1-3
	19-39	27-35	0.2-0.6	0.09-0.11	5.6-7.3	Low----------	0.15			
	39	---	---	---	---	----------	----			
Barnabe Variant-	0-13	15-27	0.6-2.0	0.08-0.10	6.1-7.3	Low----------	0.15	1	8	1-3
	13	---	---	---	---	----------	----			
178*, 179*, 180*:										
Tocaloma--------	0-19	18-25	2.0-6.0	0.10-0.15	5.6-6.5	Low----------	0.32	3	8	1-2
	19-39	20-27	2.0-6.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	39	---	---	---	---	----------	----			
McMullin--------	0-4	15-27	0.6-2.0	0.10-0.15	5.6-6.5	Low----------	0.17	1	8	1-3
	4-18	20-35	0.6-2.0	0.14-0.17	5.6-6.5	Low----------	0.20			
	18	---	---	---	---	----------	----			
181*, 182*:										
Tocaloma--------	0-19	18-25	2.0-6.0	0.10-0.15	5.6-6.5	Low----------	0.32	3	8	1-2
	19-39	20-27	2.0-6.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	39	---	---	---	---	----------	----			
McMullin--------	0-4	15-27	0.6-2.0	0.10-0.15	5.6-6.5	Low----------	0.17	1	8	1-3
	4-18	20-35	0.6-2.0	0.14-0.17	5.6-6.5	Low----------	0.20			
	18	---	---	---	---	----------	----			
Urban land.										
183*, 184*, 185*:										
Tocaloma--------	0-19	18-25	2.0-6.0	0.10-0.15	5.6-6.5	Low----------	0.32	3	8	1-2
	19-39	20-27	2.0-6.0	0.07-0.10	5.6-6.5	Low----------	0.15			
	39	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
183*, 184*, 185*:										
Saurin	0-10	27-33	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.32	2	8	1-3
	10-33	30-35	0.6-2.0	0.16-0.19	5.6-6.5	Moderate	0.37			
	33	---	---	---	---	---	---			
186, 187, 188, 189										
Tomales	0-12	15-20	0.6-2.0	0.10-0.12	5.6-6.5	Low	0.32	3	7	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
190, 191, 192, 193										
Tomales	0-12	20-27	0.6-2.0	0.14-0.16	5.6-6.5	Low	0.32	3	8	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
194*:										
Tomales	0-12	20-27	0.6-2.0	0.14-0.16	5.6-6.5	Low	0.32	3	8	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
Sobega	0-17	18-25	0.6-2.0	0.13-0.16	4.5-6.0	Low	0.32	2	8	1-4
	17-22	18-27	0.6-2.0	0.11-0.15	5.1-6.0	Low	0.37			
	22	---	---	---	---	---	---			
195*, 196*:										
Tomales	0-12	15-20	0.6-2.0	0.10-0.12	5.6-6.5	Low	0.32	3	7	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
Sobega	0-17	18-20	0.6-2.0	0.11-0.13	4.5-6.0	Low	0.32	2	7	1-4
	17-22	18-27	0.6-2.0	0.11-0.15	5.1-6.0	Low	0.37			
	22	---	---	---	---	---	---			
197*:										
Tomales	0-12	15-20	0.6-2.0	0.10-0.12	5.6-6.5	Low	0.32	3	7	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
Steinbeck	0-35	15-25	0.6-2.0	0.13-0.17	5.6-6.5	Low	0.28	2	7	2-4
	35-48	25-35	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	0.32			
	48	---	---	---	---	---	---			
198*, 199*, 200*:										
Tomales	0-12	20-27	0.6-2.0	0.14-0.16	5.6-6.5	Low	0.32	3	8	1-6
	12-24	15-27	0.6-2.0	0.14-0.17	5.1-6.5	Low	0.37			
	24-47	35-50	<0.06	0.12-0.15	4.5-5.5	High	0.28			
	47	---	---	---	---	---	---			
Steinbeck	0-35	15-25	0.6-2.0	0.13-0.17	5.6-6.5	Low	0.28	2	7	2-4
	35-48	25-35	0.6-2.0	0.15-0.19	5.6-7.3	Moderate	0.32			
	48	---	---	---	---	---	---			
201*:										
Urban land.										
Ballard	0-19	10-20	0.6-2.0	0.12-0.15	5.6-6.5	Low	0.20	5	8	1-3
	19-65	18-27	0.6-2.0	0.12-0.15	5.6-6.5	Low	0.20			
202*:										
Urban land.										
Xerorthents.										

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	Pct	In/hr	In/in	pH					Pct
203*. Xerorthents										
204*: Xerorthents.										
Urban land.										
205, 206--------- Yorkville	0-14	27-32	0.2-0.6	0.17-0.18	5.6-7.8	Moderate-----	0.32	1	8	1-2
	14-51	35-50	<0.06	0.15-0.28	6.6-8.4	High---------	0.24			
	51	---	---	---	---	---	---			
207---------- Yorkville	0-10	27-32	0.2-0.6	0.17-0.18	5.6-7.8	Moderate-----	0.32	1	8	1-2
	10-45	35-50	<0.06	0.15-0.28	6.6-8.4	High---------	0.24			
	45	---	---	---	---	---	---			
208*, 209*: Yorkville-------	0-14	27-32	0.2-0.6	0.17-0.18	5.6-7.8	Moderate-----	0.32	1	8	1-2
	14-51	35-50	<0.06	0.15-0.28	6.6-8.4	High---------	0.24			
	51	---	---	---	---	---	---			
Rock outcrop.										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
101---------- Ballard	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
102*: Ballard----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Urban land.											
103---------- Barnabe	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
104*. Beaches											
105*: Blucher----------	C	Occasional	Very brief	Dec-Apr	3.5-5.0	Apparent	Dec-Apr	>60	---	High-----	Moderate.
Cole----------	C	Occasional	Brief-----	Nov-Mar	1.5-3.0	Apparent	Nov-May	>60	---	High-----	Moderate.
106, 107---------- Bonnydoon	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	Low.
108*: Bonnydoon Variant	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Low.
Gilroy----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Low.
Gilroy Variant---	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Low.
109*: Bressa Variant---	B	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	High.
McMullin Variant-	C	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	Moderate.
110*, 111*, 112*: Centissima-------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
Barnabe----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
113---------- Clear Lake	D	Rare--------	---	---	3-6	Apparent	Dec-Mar	>60	---	High-----	High.
114---------- Cortina	A	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Low.
115*, 116*, 117*, 118*: Cronkhite-------	C	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	Moderate.
Barnabe----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
119*, 120*: Dipsea----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate.
Barnabe----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
121*: Dipsea----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate.
Urban land.											
Barnabe----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
122*. Dune land											

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
123*, 124*, 125*, 126*:											
Felton Variant--	C	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	Low.
Soulajule-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
127*. Fluvents											
128*:											
Gilroy----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Low.
Gilroy Variant---	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Low.
Bonnydoon Variant	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Low.
129---------- Henneke	D	None--------	---	---	>6.0	---	---	10-20	Hard	High-----	Moderate.
130*. Humaquepts											
131*. Hydraquents											
132, 133, 134, 135----------											
Inverness	B	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	Low.
136, 137---------- Kehoe	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate
138, 139---------- Kehoe Variant	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate.
140*, 141*, 142*:											
Los Osos---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
Bonnydoon--------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	Low.
143*, 144*:											
Los Osos---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
Urban land.											
Bonnydoon--------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Moderate	Low.
145*:											
Maymen----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	High-----	High.
Maymen Variant---	D	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
146---------- Montara	D	None--------	---	---	>6.0	---	---	10-20	Hard	High-----	Low.
147---------- Novato	D	Frequent----	Very brief	Jan-Dec	+2-2.0	Apparent	Jan-Dec	>60	---	High-----	High.
148, 149, 150----- Olompali	D	None--------	---	---	1.0-2.0	Perched	Dec-Mar	>60	---	High-----	Moderate.
151*, 152*:											
Pablo----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate.
Bayview----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
153*, 154*, 155*, 156*:											
Palomarin	B	None	---	---	>6.0	---	---	40-60	Hard	High	Moderate.
Wittenberg	B	None	---	---	>6.0	---	---	40-60	Hard	High	Moderate.
157*. Pits											
158 Reyes	D	Rare	---	---	3.0-5.0	Apparent	Jan-Dec	>60	---	High	High.
159*:											
Rock outcrop.											
Xerorthents.											
160 Rodeo	D	None	---	---	1.5-3.0	Apparent	Dec-Apr	>60	---	High	High.
161*, 162*, 163*, 164*:											
Saurin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Bonnydoon	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	Low.
165*, 166*:											
Saurin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
Urban land.											
Bonnydoon	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	Low.
167, 168, 169 Sheridan Variant	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
170, 171 Sirdrak	A	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
172 Sirdrak Variant	D	None	---	---	2.0-3.0	Perched	Dec-Mar	>60	---	Moderate	Moderate.
173, 174 Sobega	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
175*, 176*, 177*:											
Tamalpais	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Barnabe Variant	C	None	---	---	>6.0	---	---	10-20	Hard	Low	Low.
178*, 179*, 180*:											
Tocaloma	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
McMullin	D	None	---	---	>6.0	---	---	12-20	Hard	Moderate	Moderate.
181*, 182*:											
Tocaloma	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
McMullin	D	None	---	---	>6.0	---	---	12-20	Hard	Moderate	Moderate.
Urban land.											
183*, 184*, 185*:											
Tocaloma	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
Saurin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
186, 187, 188, 189, 190, 191, 192, 193--- Tomales	D	None---	---	---	>6.0	---	---	40-60	Soft	High---	Moderate.
194*, 195*, 196*: Tomales---	D	None---	---	---	>6.0	---	---	40-60	Soft	High---	Moderate.
Sobega---	C	None---	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate.
197*, 198*, 199*, 200*: Tomales---	D	None---	---	---	>6.0	---	---	40-60	Soft	High---	Moderate.
Steinbeck---	B	None---	---	---	>6.0	---	---	40-60	Soft	Moderate	Low.
201*: Urban land.											
Ballard---	B	None---	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
202*: Urban land.											
Xerorthents.											
203*. Xerorthents											
204*: Xerorthents.											
Urban land.											
205, 206, 207--- Yorkville	D	None---	---	---	>6.0	---	---	40-60	Soft	High---	Low.
208*, 209*: Yorkville---	D	None---	---	---	>6.0	---	---	40-60	Soft	High---	Low.
Rock outcrop.											

* See description of the map unit for composition and behavior characteristics of the map unit.

**In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 16.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family
*Ballard	Fine-loamy, mixed, thermic Typic Argixerolls
Barnabe	Loamy-skeletal, mixed, isomesic Lithic Haplustolls
Barnabe Variant	Loamy-skeletal, mixed, isomesic Lithic Haplustolls
Bayview	Loamy-skeletal, mixed, isomesic Lithic Haplustolls
Blucher	Fine-loamy, mixed, thermic Fluvaquentic Haploxerolls
Bonnydoon	Loamy, mixed, thermic, shallow Entic Haploxerolls
Bonnydoon Variant	Loamy, mixed, thermic Lithic Haploxerolls
Bressa Variant	Fine-loamy, mixed, mesic Mollic Haploxeralfs
Centissima	Fine-loamy, mixed, isomesic Typic Dystropepts
Clear Lake	Fine, montmorillonitic, thermic Typic Pelloxererts
Cole	Fine, mixed, thermic Pachic Argixerolls
Cortina	Loamy-skeletal, mixed, nonacid, thermic Typic Xerofluvents
Cronkhite	Fine, montmorillonitic, isomesic Pachic Argiustolls
Dipsea	Loamy-skeletal, mixed, isomesic Typic Tropudalfs
Felton Variant	Fine, mixed, mesic Pachic Ultic Argixerolls
Gilroy	Fine-loamy, mixed, thermic Typic Argixerolls
Gilroy Variant	Fine-loamy, mixed, thermic Typic Argixerolls
Henneke	Clayey-skeletal, serpentinitic, thermic Lithic Argixerolls
Inverness	Fine-loamy, mixed, isomesic Ultic Haplustalfs
Kehoe	Fine-loamy, mixed, isomesic Pachic Haplustolls
Kehoe Variant	Coarse-loamy, mixed, isomesic Pachic Haplustolls
Los Osos	Fine, montmorillonitic, thermic Typic Argixerolls
Maymen	Loamy, mixed, mesic Dystric Lithic Xerochrepts
Maymen Variant	Clayey, mixed, mesic Typic Haploxerults
McMullin	Loamy, mixed, mesic Lithic Ultic Haploxerolls
McMullin Variant	Loamy, mixed, mesic, shallow Typic Xerochrepts
Montara	Loamy, serpentinitic, thermic Lithic Haploxerolls
Novato	Fine, mixed, nonacid, isomesic Typic Hydraquents
Olompali	Fine, montmorillonitic, mesic Ultic Palexeralfs
Pablo	Loamy, mixed, isomesic Lithic Haplustolls
Palomarin	Fine-loamy, mixed, isomesic Typic Dystropepts
Reyes	Fine, mixed, acid, thermic Sulfic Fluvaquents
Rodeo	Fine, montmorillonitic, isomesic Aquic Paleustolls
*Saurin[1]	Fine-loamy, mixed, thermic Typic Haploxerolls
Sheridan Variant	Coarse-loamy, mixed, isomesic Ustic Dystropepts
Sirdrak	Sandy, mixed, isomesic Ustic Dystropepts
Sirdrak Variant	Sandy, mixed, isomesic Aquic Dystropepts
*Sobega[1]	Fine-loamy, mixed, mesic Udic Ustochrepts
Soulajule	Clayey-skeletal, mixed, mesic Ultic Haploxeralfs
*Steinbeck[1]	Fine-loamy, mixed, mesic Ultic Haplustalfs
Tamalpais	Loamy-skeletal, mixed, isomesic Typic Argiustolls
Tocaloma	Fine-loamy, mixed, mesic Typic Haploxerolls
*Tomales[1]	Fine, mixed, mesic Ultic Paleustalfs
Wittenberg	Loamy-skeletal, mixed, isomesic Typic Dystropepts
Yorkville	Fine, mixed, thermic Typic Argixerolls

[1]Not all soils in this series are taxadjuncts. The soils that are taxadjuncts are listed at the end of the series description.

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SOIL ASSOCIATIONS

SOILS ON ALLUVIAL FANS AND PLAINS, IN BASINS, AND ON TIDAL FLATS

1 — Blucher-Cole: Very deep, gently sloping, somewhat poorly drained soils; in basins and on alluvial fans

2 — Reyes-Novato: Very deep, nearly level, somewhat poorly drained and very poorly drained soils; on tidal flats

3 — Urban land-Xerorthents: Urban land, and deep, nearly level to moderately sloping soils; on alluvial fans, alluvial plains, and tidal flats

4 — Xerorthents-Urban land: Deep, nearly level to sloping soils, and Urban land; on alluvial fans, alluvial plains, and tidal flats

COASTAL SOILS ON DUNES, TERRACES, HILLS, MOUNTAINS, AND UPLANDS

5 — Dune land-Sirdrak: Dune land, and very deep, gently sloping to steep, somewhat excessively drained soils; on coastal dunes

6 — Kehoe-Sheridan Variant: Moderately deep, strongly sloping to very steep, well drained soils underlain by sandstone and quartz-diorite; on hills

7 — Palomarin-Wittenberg: Deep, strongly sloping to very steep, well drained soils underlain by siliceous shale and sandstone; on hills and mountains

8 — Pablo-Bayview: Shallow, moderately steep to very steep, well drained soils underlain by siliceous shale and sandstone; on uplands

9 — Cronkhite-Dipsea-Centissima: Moderately deep and deep, strongly sloping to very steep, moderately well drained and well drained soils underlain by sandstone and shale; on uplands

10 — Tamalpais-Barnabe Variant: Shallow and moderately deep, moderately steep to very steep, well drained soils underlain by chert and sandstone; on uplands

11 — Tomales-Steinbeck: Deep, gently sloping to steep, moderately well drained and well drained soils underlain by soft sandstone; on uplands

12 — Olompali-Soulajule-Felton Variant: Moderately deep and deep, gently sloping to very steep, somewhat poorly drained and well drained soils; on terraces and uplands

INLAND SOILS ON UPLANDS

13 — Tocaloma-Saurin: Moderately deep, gently sloping to very steep, well drained soils underlain by sandstone and shale; on uplands

14 — Los Osos-Bonnydoon: Shallow and moderately deep, gently sloping to very steep, well drained and somewhat excessively drained soils underlain by sandstone and shale; on uplands

15 — Tocaloma-McMullin: Shallow and moderately deep, moderately steep to very steep, well drained soils underlain by sandstone and shale; on uplands

16 — Maymen-Maymen Variant: Shallow and moderately deep, steep and very steep, somewhat excessively drained and well drained soils underlain by sandstone and shale; on uplands

17 — Tocaloma-McMullin-Urban land: Moderately deep and shallow, well drained, moderately steep to very steep soils underlain by sandstone and shale, and Urban land; on uplands

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXPERIMENT STATION

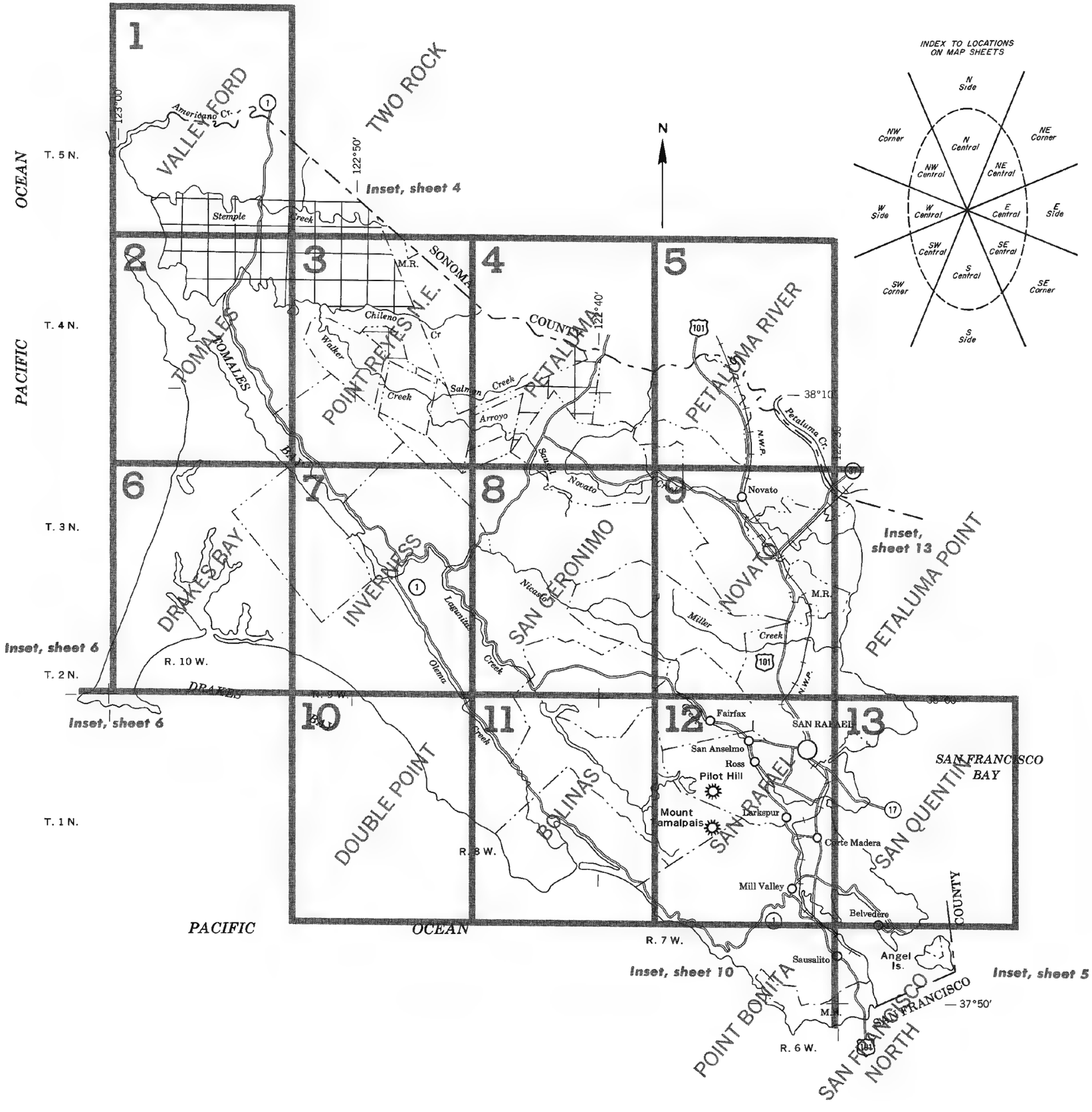
GENERAL SOIL MAP

MARIN COUNTY, CALIFORNIA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km



INDEX TO LOCATIONS ON MAP SHEETS

LOCATION OF PROFILES REPRESENTATIVE OF SOIL SERIES

NAME OF SERIES	SHEET NUMBER	PART OF SHEET
Ballard Series	4	NW Corner
Barnabe	12	So. Side
Barnabe Variant	Inset to 10	SE Corner
Bayview	7	W. Side
Blucher	5	W. Central
Boonydoon	8	NW Corner
Boonydoon Variant	5	So. Side
Bressa Variant	5	So. Side
Centissima	11	NW Corner
Clear Lake	3	So. Central
Cole Series	8	NW Central
Cortina	3	SE Corner
Cronkhite	Inset to 10	W. Side
Dipsea	11	N. Side
Felton Variant	3	SW Corner
Gilroy	5	SW Corner
Gilroy Variant	5	So. Side
Henneke	11	NE Corner
Iverness	7	NW Corner
Kehoe	2	So. Central
McMullin	8	SE Corner
McMullin Variant	9	NE Corner
Montara	5	SW Corner
Novato	5	SE Corner
Kehoe Variant	2	NW Central
Los Osos	4	SW Corner
Maymen	12	SW Central
Maymen Variant	12	SW Central
Olompali	2	E Side
Pablo	7	W Side
Palomarin	10	NE Corner
Reyes	5	SE Central
Rodeo	Inset to 10	SE Corner
Saurin	11	NE Corner
Sheridan Variant	6	NE Corner
Sirdrak	2	So Side
Sirdrak Variant	6	N. Central
Sobega	2	NE Corner
Soulajule	3	SW Corner
Steinbeck	1	So Side
Tamalpais	Inset to 10	SE Corner
Tocaloma	4	W. Central
Tomales	1	SW Central
Wittenberg	10	NE Corner
Yorkville	3	NW Central

INDEX TO MAP SHEETS

MARIN COUNTY, CALIFORNIA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SOIL LEGEND

SYMBOL	NAME
101	Ballard gravelly loam, 2 to 9 percent slopes
102	Ballard-Urban land complex, 0 to 9 percent slopes
103	Barnabe very gravelly loam, 30 to 50 percent slopes
104	Beaches
105	Blucher-Cole complex, 2 to 5 percent slopes
106	Bonnydoon gravelly loam, 15 to 30 percent slopes
107	Bonnydoon gravelly loam, 30 to 75 percent slopes
108	Bonnydoon Variant - Gilroy - Gilroy Variant loams, 50 to 75 percent slopes
109	Bressa Variant-McMullin Variant complex, 30 to 50 percent slopes
110	Centissima-Barnabe complex, 15 to 30 percent slopes
111	Centissima-Barnabe complex, 30 to 50 percent slopes
112	Centissima-Barnabe complex, 50 to 75 percent slopes
113	Clear Lake clay
114	Cortina gravelly sandy loam, 0 to 5 percent slopes
115	Cronkhite-Barnabe complex, 9 to 15 percent slopes
116	Cronkhite-Barnabe complex, 15 to 30 percent slopes
117	Cronkhite-Barnabe complex, 30 to 50 percent slopes
118	Cronkhite-Barnabe complex, 50 to 75 percent slopes
119	Dipsea-Barnabe very gravelly loams, 30 to 50 percent slopes
120	Dipsea-Barnabe very gravelly loams, 50 to 75 percent slopes
121	Dipsea-Urban land-Barnabe complex, 30 to 50 percent slopes
122	Dune land
123	Felton Variant-Soulajule complex, 9 to 15 percent slopes
124	Felton Variant-Soulajule complex, 15 to 30 percent slopes
125	Felton Variant-Soulajule complex, 30 to 50 percent slopes
126	Felton Variant-Soulajule complex, 50 to 75 percent slopes
127	Fluvents, channeled
128	Gilroy-Gilroy Variant-Bonnydoon Variant loams, 30 to 50 percent slopes
129	Henneke stony clay loam, 15 to 50 percent slopes
130	Humaquepts, seeped
131	Hydraquents, saline
132	Inverness loam, 9 to 15 percent slopes
133	Inverness loam, 15 to 30 percent slopes
134	Inverness loam, 30 to 50 percent slopes
135	Inverness loam, 50 to 75 percent slopes
136	Kehoe loam, 9 to 15 percent slopes
137	Kehoe loam, 15 to 50 percent slopes
138	Kehoe Variant coarse sandy loam, 9 to 15 percent slopes
139	Kehoe Variant coarse sandy loam, 15 to 50 percent slopes
140	Los Osos-Bonnydoon complex, 5 to 15 percent slopes
141	Los Osos-Bonnydoon complex, 15 to 30 percent
142	Los Osos-Bonnydoon complex, 30 to 50 percent slopes
143	Los Osos-Urban land-Bonnydoon complex, 15 to 30 percent slopes
144	Los Osos-Urban land-Bonnydoon complex, 30 to 50 percent slopes
145	Maymen-Maymen Variant gravelly loams, 30 to 75 percent slopes
146	Montara clay loam, 15 to 30 percent slopes
147	Novato clay
148	Olompali loam, 2 to 9 percent slopes
149	Olompali loam, 9 to 15 percent slopes
150	Olompali loam, 15 to 30 percent slopes
151	Pablo-Bayview complex, 15 to 50 percent slopes
152	Pablo-Bayview complex, 50 to 75 percent slopes
153	Palomarin-Wittenberg complex, 9 to 15 percent slopes
154	Palomarin-Wittenberg complex, 15 to 30 percent slopes
155	Palomarin-Wittenberg complex, 30 to 50 percent slopes
156	Palomarin-Wittenberg complex, 50 to 75 percent slopes
157	Pits, quarries
158	Reyes clay
159	Rock outcrop-Xerorthents complex, 50 to 75 percent slopes
160	Rodeo clay loam, 2 to 15 percent slopes
161	Saurin-Bonnydoon complex, 2 to 15 percent slopes
162	Saurin-Bonnydoon complex, 15 to 30 percent slopes
163	Saurin-Bonnydoon complex, 30 to 50 percent slopes
164	Saurin-Bonnydoon complex, 50 to 75 percent slopes
165	Saurin-Urban land-Bonnydoon complex, 15 to 30 percent slopes
166	Saurin-Urban land-Bonnydoon complex, 30 to 50 percent slopes
167	Sheridan Variant coarse sandy loam, 9 to 30 percent slopes
168	Sheridan Variant coarse sandy loam, 30 to 50 percent slopes
169	Sheridan Variant coarse sandy loam, 50 to 75 percent slopes
170	Sirdrak sand, 2 to 15 percent slopes
171	Sirdrak sand, 15 to 50 percent slopes
172	Sirdrak Variant sand, 0 to 5 percent slopes
173	Sobega loam, 9 to 15 percent slopes
174	Sobega loam, 15 to 30 percent slopes
175	Tamalpais-Barnabe Variant very gravelly loams, 15 to 30 percent slopes
176	Tamalpais-Barnabe Variant very gravelly loams, 30 to 50 percent slopes
177	Tamalpais-Barnabe Variant very gravelly loams, 50 to 75 percent slopes
178	Tocaloma-McMullin complex, 15 to 30 percent slopes
179	Tocaloma-McMullin complex, 30 to 50 percent slopes
180	Tocaloma-McMullin complex, 50 to 75 percent slopes
181	Tocaloma-McMullin-Urban land complex, 15 to 30 percent slopes
182	Tocaloma-McMullin-Urban land complex, 30 to 50 percent slopes
183	Tocaloma-Saurin association, steep
184	Tocaloma-Saurin association, very steep
185	Tocaloma-Saurin association, extremely steep
186	Tomales fine sandy loam, 2 to 9 percent slopes
187	Tomales fine sandy loam, 9 to 15 percent slopes
188	Tomales fine sandy loam, 15 to 30 percent slopes
189	Tomales fine sandy loam, 30 to 50 percent slopes
190	Tomales loam, 2 to 9 percent slopes
191	Tomales loam, 9 to 15 percent slopes
192	Tomales loam, 15 to 30 percent slopes
193	Tomales loam, 30 to 50 percent slopes
194	Tomales-Sobega loams, 15 to 30 percent slopes
195	Tomales-Sobega complex, 9 to 15 percent slopes
196	Tomales-Sobega complex, 15 to 30 percent slopes
197	Tomales-Steinbeck fine sandy loams, 30 to 50 percent slopes
198	Tomales-Steinbeck loams, 5 to 15 percent slopes
199	Tomales-Steinbeck loams, 15 to 30 percent slopes
200	Tomales-Steinbeck loams, 30 to 50 percent slopes
201	Urban land-Ballard complex, 0 to 9 percent slopes
202	Urban land-Xerorthents complex, 0 to 9 percent slopes
203	Xerorthents, fill
204	Xerorthents-Urban land complex, 0 to 9 percent slopes
205	Yorkville clay loam, 9 to 15 percent slopes
206	Yorkville clay loam, 15 to 30 percent slopes
207	Yorkville clay loam, 30 to 50 percent slopes
208	Yorkville-Rock outcrop complex, 9 to 15 percent slopes
209	Yorkville-Rock outcrop complex, 15 to 30 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label) — Hedley Airstrip
- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE
- STATE COORDINATE TICK
- LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

- RAILROAD
- POWER TRANSMISSION LINE (normally not shown)
- PIPE LINE (normally not shown)
- FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

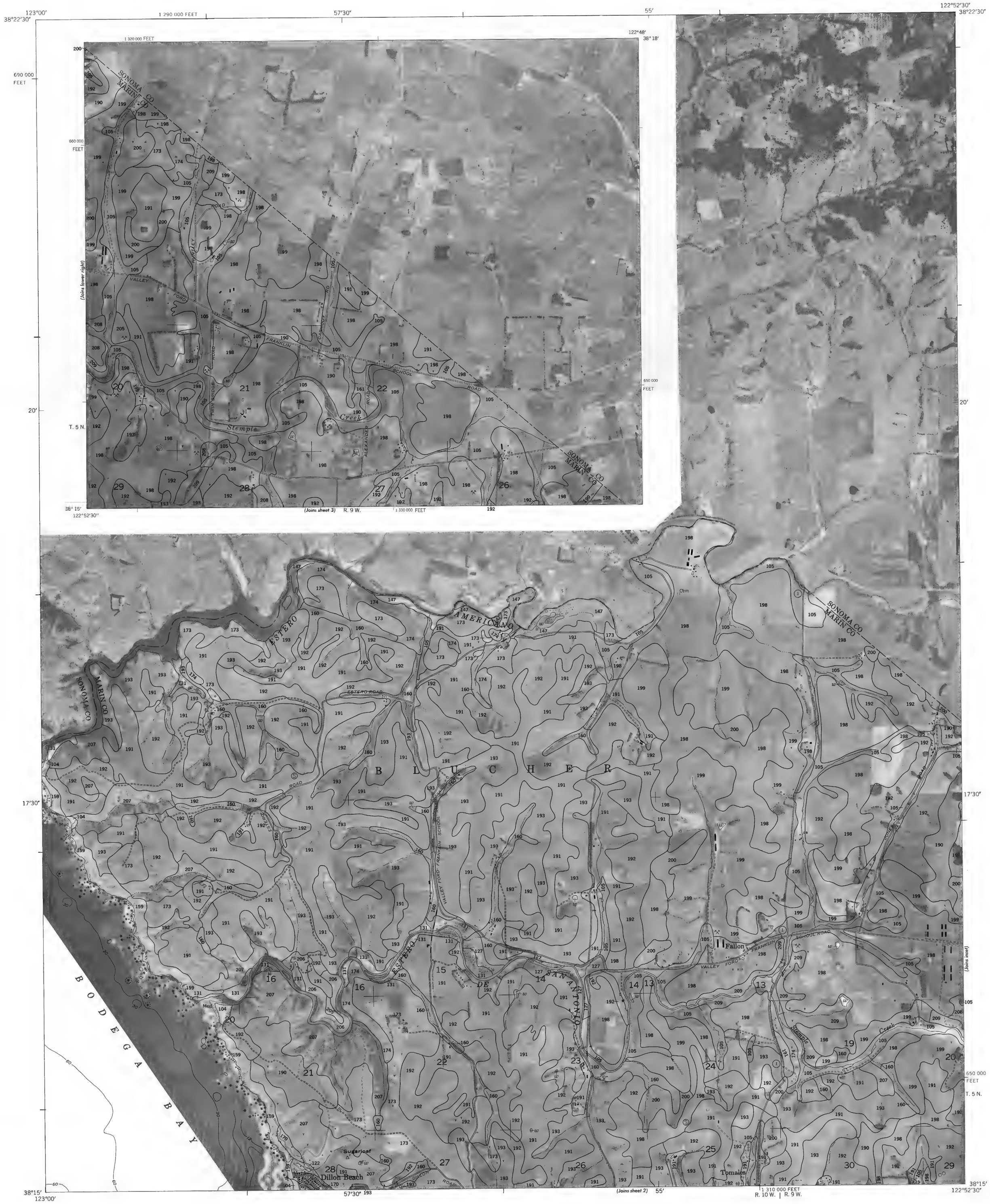
- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS — 101 / 200
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE SITE (normally not shown) — S
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 1
MARIN COUNTY, CALIFORNIA
(VALLEY FORD QUADRANGLE AND PART OF TWO ROCK QUADRANGLE)



This soil survey was compiled in 1978 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

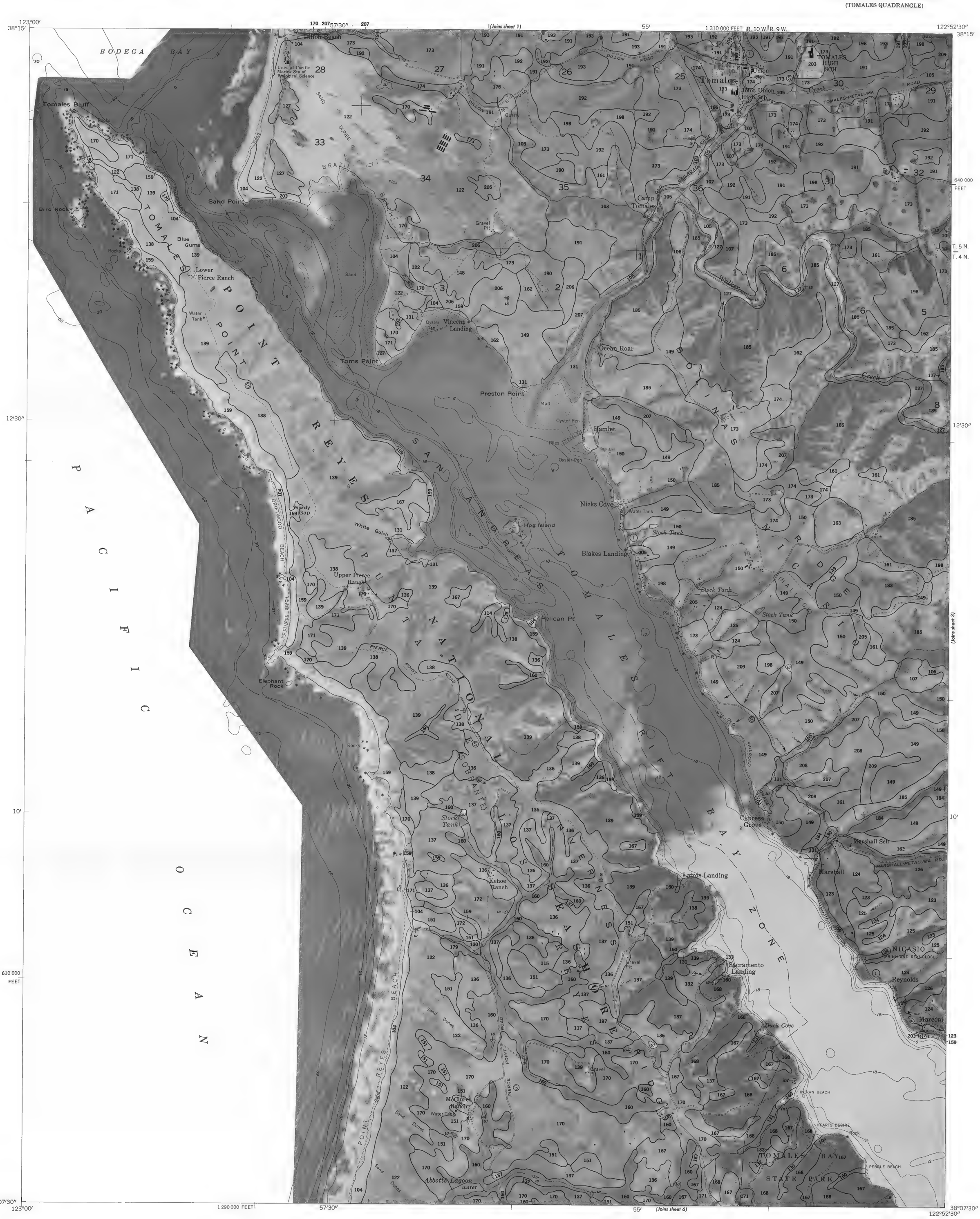
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophotobase compiled from 1976 aerial photography by the U.S. Department of The Interior, Geological Survey. Planimetric detail obtained from 7½ minute series maps. 10,000-foot grid based on state coordinate system.

MARIN COUNTY, CALIFORNIA NO. 1

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 2
MARIN COUNTY, CALIFORNIA
(TOMALES QUADRANGLE)



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MARIN COUNTY, CALIFORNIA NO. 2

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 3
MARIN COUNTY, CALIFORNIA
(POINT REYES NORTHEAST QUADRANGLE)

This soil survey was compiled in 1978 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

1 ⅝ ½ ⅛ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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MARIN COUNTY, CALIFORNIA NO. 3

122°45′ 38°15′ — 42′30″ — 40′ — 1 380 000 FEET — 122°37′30″ 38°15′

640 000 FEET

12′30″

Laguna Lake
SONOMA CO
MARIN CO
Quarry
CHILENO VALLEY ROAD
Clayton Valley Elem Sch
Concord Police Academy
Laguna Sch
GRANT ROAD
San Antonio BOUNDARY Creek
Antonio Mtn
VABM 1171
Highlands Sch
Pine Hollow Intermediate Sch
MARSHALL-PETALUMA ROAD
Res
Union Sch
water
GRANT BDY
PIPELINE
WILSON Creek
Salmon
Hammock Hill
ROAD
Reservoir
Landing Strip
Red Hill 1257
Lincoln Sch
POINT REYES-PETALUMA
Quarry
HICKS VALLEY
Hicks Mtn
SOULAJULE (WATKINS)
SOULAJULE (CORNWALL)
HICKS VALLEY
CORTE MADERA DE NOVATO
NOVATO
NICASIO (HALLECK)
Bowman Canyon
OLOMPALI

(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 8)

10′

T. 4 N.
T. 3 N.

600 000 FEET

38°07′30″ 122°45′ — 1 360 000 FEET — 42′30″ — R. 8 W. | R. 7 W. — 40′ — 38°07′30″ 122°37′30″

1 ⅝ ½ ⅛ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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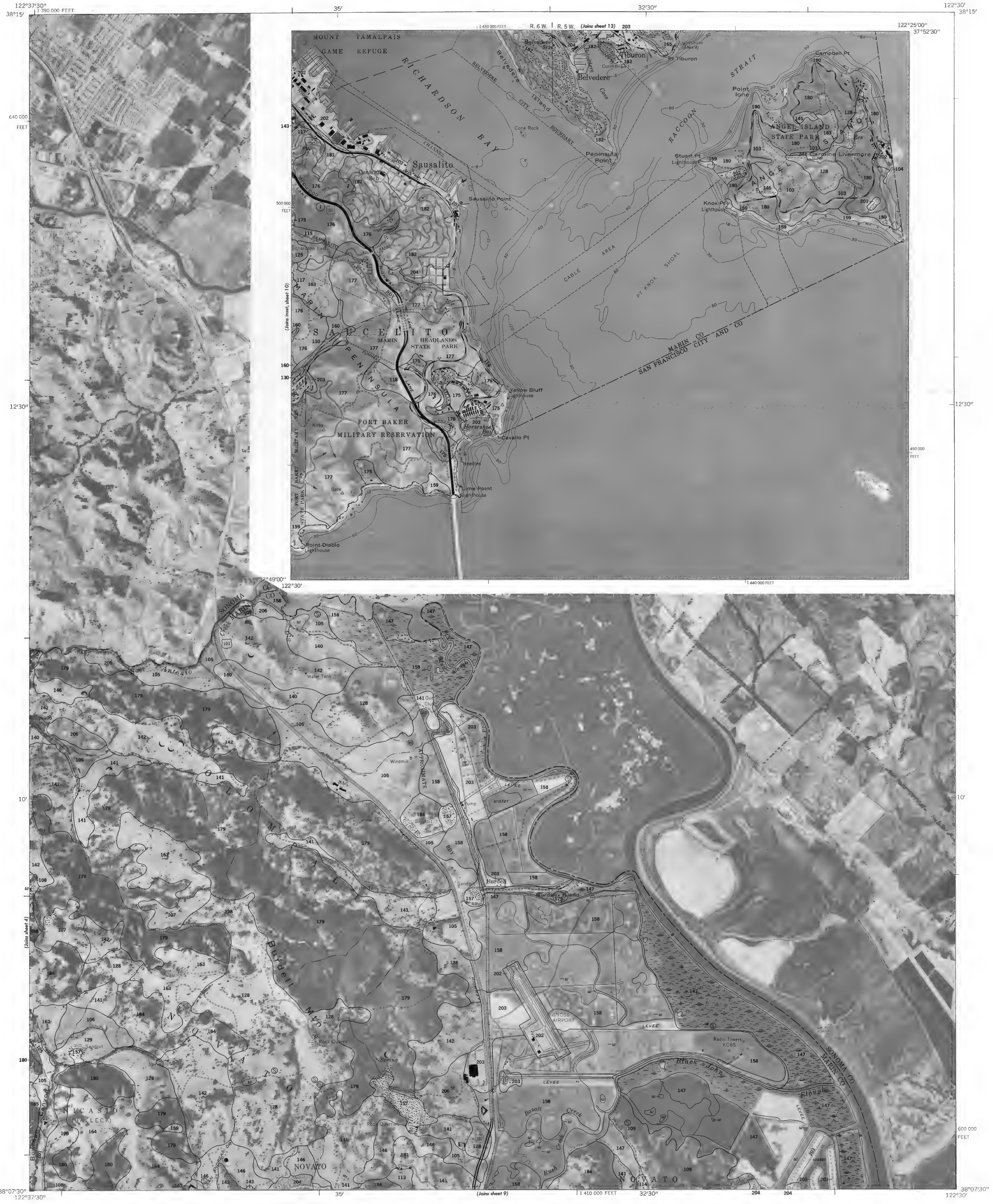

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1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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MARIN COUNTY, CALIFORNIA NO. 5


123°00′
38°07′30″
57′30″
55′ (Joins sheet 2)
1 310 000 FEET
122°52′30″
38°07′30″
INSET A
1 276 000 FEET
123°00′
38°02′00″
565 000 FEET
560 000 FEET
(Joins lower left)
38°00′
123°01′30″
(Joins inset B)
1 279 000 FEET
3000 AND 5000-FOOT GRID TICKS
Abbotts Lagoon
Coast Guard Buildings
Quarry
H Ranch
PIERCE POINT ROAD
M Ranch
Water Tank
TOMALES BAY STATE PARK
SHALLOW BEACH
Tomales Bay
INVERNESS RIDGE
DRAKE HIGHWAY
APPROXIMATE BDY
SIR FRANCIS DRAKE HIGHWAY
Radio Sta
Radio Towers
Blacksmith Shop (Site)
MT. VISION ROAD
590 000 FEET
SAND DUNES
POINT REYES BEACH
Parking Area
Mud
Schooner Ldg (Site)
POINT REYES NATIONAL SEASHORE
PUNTA DE LOS REYES
RANCHO PUNTA DE LOS REYES SOBRANTE
Spring
Home Ranch
Home Ranch Creek
Creek
Schooner Bay
Home Bay
Creamery Bay
Bull Point
Well
Barries Bay
Quarry
(Joins sheet 7)
water
Windmill
DRAKES ESTERO
Glenbrook Creek
2′30″
570 000 FEET
D Ranch
Drakes Head
Estero de Limantour
LIMANTOUR SPIT
Sand
Drakes Beach
(Joins inset A)
38°00′
123°00′
(Joins Inset C)
1 290 000 FEET
57′30″
55′
38°00′
122°52′30″
INSET B
1 275 000 FEET
(Joins inset A)
123°00′
38°00′
555 000 FEET
COAST GUARD RESERVATION
Point Reyes
Tank
Lighthouse
Radio Tower
Sea Lion Cove
Rocks
(Joins Inset C)
552 000 FEET
37°59′16″
123°01′30″
3000-FOOT GRID TICKS
1 278 000 FEET
INSET C
1 280 000 FEET
(Joins lower left)
122°57′30″
38°00′
555 000 FEET
(Joins inset B)
Fuel Tank
PRIVATE
Point Reyes
Rocks
Chimney Rock
552 000 FEET
37°59′16″
123°00′
3000 AND 10 000-FOOT GRID TICKS
1 290 000 FEET

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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122°52'30" 50' (Joins sheet 3) 47'30" 1 350 000 FEET 122°45'
38°07'30" 38°07'30"

590 000 FEET

5'

2'30"

(Joins sheet 6) (Joins sheet 8)

560 000 FEET

38°00' 38°00'
122°52'30" 1 320 000 FEET 50' (Joins sheet 10) 47'30" 122°45'

Scale 1:24000

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1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

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MARIN COUNTY, CALIFORNIA NO. 8

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1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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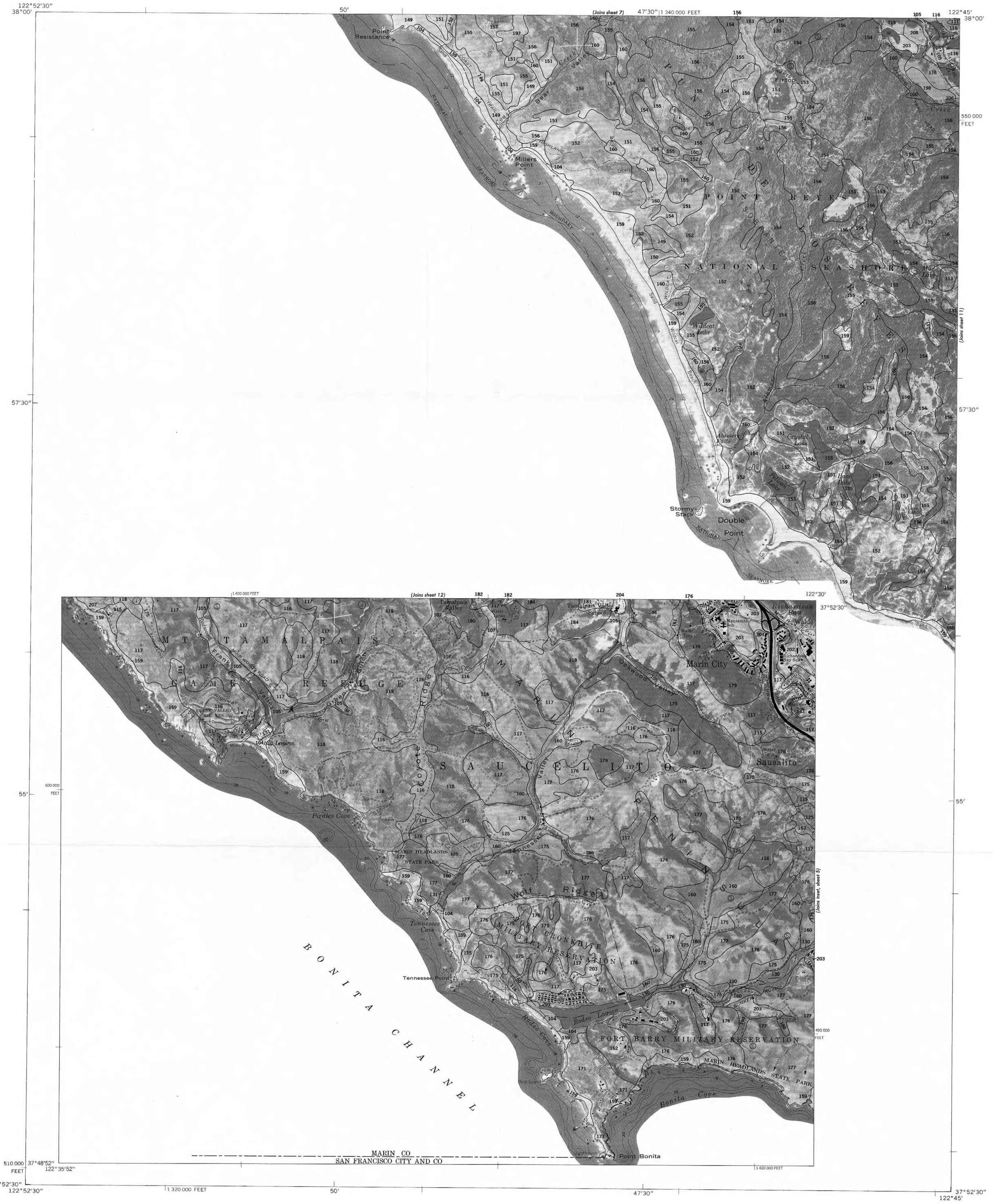
MARIN COUNTY, CALIFORNIA NO. 9

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 10
MARIN COUNTY, CALIFORNIA
(DOUBLE POINT QUADRANGLE AND PART OF POINT BONITA QUADRANGLE)



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1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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MARIN COUNTY, CALIFORNIA NO. 10


122°45′
38°00′
42′30″
(Joins sheet 8)
40′
1 380 000 FEET
122°37′30″
38°00′
550 000 FEET
(Joins sheet 10)
(Joins sheet 12)
57′30″
55′
510 000 FEET
37°52′30″
122°45′
1 360 000 FEET
42′30″
40′
37°52′30″
122°37′30″
TOMALES Y
BAULINES (CAROTA)
SAN ANDREAS
BOLINAS RIDGE
TOMALES
KENT LAKE
PETERS DAM SPILLWAY 355
SAN GERONIMO
Big Carson Creek
Green Hill
Pine Mountain Ridge
Pine Mtn
White Hill
CANADA DE HERRERA
San Anselmo Creek
Happersberger Pt
Liberty Gulch
Lagunitas
Pump
(PHELPS)
Lily Gl
BAULINES RIDGE
Oat Hill
ALPINE LAKE
ALPINE DAM
SPILLWAY 644
GAME REFUGE
Blake Can
East Fork
Cataract Creek
Laurel Dell Campground
MT TAMALPAIS
PUNTA DE LOS REYES SOBRANTE
POINT REYES NATIONAL SEASHORE
Olema Creek
Reservoir
Dogtown
RIFT ZONE
Pine Gulch
BOUNDARY
Copper Mine Gulch
Tunnel
Woodville
Wilkins Gulch
Pike County Gulch
Audubon Canyon
Audubon Canyon Ranch
McKinnan Gulch Mine
Arroyo Hondo
Pablo Point
Mc Cormick Creek
Stewart Point
Paradise Valley
Creek
LAS BAULINES
Morses Gulch
McKinnan Gulch
Stinson Gulch
BOLINAS MILITARY RES
Substation
Water Tanks
Bolinas Sch
Beacon
RADIO TOWERS
Bolinas Point
Bolinas
QUAIL REFUGE
AGATE BEACH COUNTY PARK
Duxbury Point
Duxbury Reef
BOLINAS LAGOON
MUD
COUNTY PARK
Coast Guard Mast
Stinson Beach Sch
Stinson Beach
STINSON STATE BEACH
Water Tank
SAUCELITO
HILL MILITARY RES
MT TAMALPAIS STATE PARK
Rocky Point
Webb Creek
PACIFIC OCEAN
BOLINAS BAY

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 12
MARIN COUNTY, CALIFORNIA
(SAN RAFAEL QUADRANGLE)

122°37′30″ 38°00′ — 35′ — R. 7 W. | R. 6 W. — (Joins sheet 9) — 32′30″ — 1 420 000 FEET — 122°30′ 38°00′

550 000 FEET

T. 2 N. — T. 1 N.

57′30″

(Joins sheet 11)

(Joins sheet 13)

55′

510 000 FEET

T. 1 N. — T. 1 S.

37°52′30″ 122°37′30″ — 1 390 000 FEET — 35′ — R. 7 W. | R. 6 W. — (Joins inset, sheet 10) — 32′30″ — 37°52′30″ 122°30′

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1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

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MARIN COUNTY, CALIFORNIA NO. 12

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 13
MARIN COUNTY, CALIFORNIA
(SAN QUENTIN QUADRANGLE AND PART OF PETALUMA POINT QUADRANGLE)

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1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophotobase compiled from 1976 aerial photography by the U.S. Department of The Interior, Geological Survey. Planimetric detail obtained from 7½ minute series maps. 10,000-foot grid based on state coordinate system.

MARIN COUNTY, CALIFORNIA NO. 13